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The Editor's notes are marked (Ed.).

FIRST PART.
ORIGINAL ARTICLES

**Entomophagous Insects
and their Practical Employment in Agriculture**

by

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After the striking success of *Noctus cardinalis* against *Aceria purpurea*, attempts to obtain similar results against other species of injurious insects and of their natural enemies, especially entomophagous insects, were made in intensity. There ensued an active search in every portion of the globe for useful insects with the object of importing them in the hope that contact with the injurious species would have beneficial results.

However, the results attendant on this recent trend of agricultural entomology have not by any means been conspicuously successful, and it is possible to believe that the choice of the auxiliary species has not always been judiciously made. It is not to be thought that the importation of entomophagous insects, simply because these latter, as such, do no direct harm to crops etc., is entirely without harmful effects.

It must be admitted that, in certain cases, the action of certain entomophagous insects, though such action be possible of an indirect nature, may be encouraged by those concerned with the protection of plants from disease. In other cases, entomophagous insects, either native or imported, may be practically useless, their activities being insufficient to check the increase of the injurious species in the required degree. In these instances the agriculturist is likely to entertain false hopes, which, after inevitable disappointment, will tend to lessen his confidence in a method which in certain cases has given brilliant results. Further, his choice will probably be extended to the men of science who have not been so careful in their choice with the necessary precaution.

In actuality, the conditions restricting this increase in which every organic species tends in the measure of its fertility to maintain the organic world, species to species, in the necessary equilibrium, are not all of similar nature. Consequently, entomophagous insects are not actually the chief check on the excessive multiplication of all the insects they victimise.

If such were the case, the hunt for the particular insect predators of each particular injurious species would certainly be justified, but the factors limiting the harmful species, or at any rate the chief of such factors, are of another nature, it is useless to call to our aid the entomophagous insects when such are not the check imposed by nature herself (1).

Apart from entomophagous insects, the factors adverse to the increase of injurious to agriculture are, under natural conditions, meteorological phenomena, the defensive reaction of the plant attacked, parasitism by means of other organisms and certain fungi, as well as other difficulties of environmental nature, may form an obstacle to the increase of the said injurious species. These factors may have a marked action in practice but they are not all within the sphere of our influence.

However that may be, whenever one hopes to obtain help from entomophagous insects, against an injurious species, one must first consider whether the former take a sufficient part in the natural control of the latter, under consideration or, whether, the controlling element is not to be found in one of the other adverse factors mentioned above. Otherwise it is useless to look for what is not present in nature.

In order to estimate the possible effect of the use of entomophagous insects against injurious species, it is therefore advisable in practice to keep in mind the part they play in the complex of adverse factors acting on the particular species we are dealing with. It is evident that according to the number, efficacy, and other attributes of each of the other inimical factors, either singly or collectively, so the part reserved to the insects which prey upon the harmful species may be very variable.

Actually, this part can only be complete and actively capable of checking the multiplication of the harmful species when this latter has to fear from all the other factors and when the entomophagous insect is itself free from much attack. The part played may be of varying order of mediocrity when not only the particular efficacy of the entomophagous insect is mediocre (owing to the adverse influence to which it is itself subjected) but also when the effect of the other inimical factors acting on the injurious species preponderates.

Finally, and this is a fact which should not be lost sight of certainly, not only in many the efficacy of entomophagous insects be completely

(1) For general considerations on the conflict, competition, etc., between animal species, where some are victims, others aggressors, I refer the reader to a note of mine taken in 1907 which gives a general table of the various conditions under which the conflict takes place in nature (see: *Considerazioni sulla rapporto tra piante, loro insetti nocivi, che li depredano* ("Redia", Vol. IV, 1907, p. 193).

may even help to defeat the object in view when, by their share in the destruction of the injurious species, they tend to oppose themselves to the actions of the other factors of control. The insects which are injurious to the injurious species (from our point of view the only ones which are) rather than exert an appreciably useful action upon the injurious species.

ACTION OF ENTOMOPHAGOUS INSECTS AND THEIR EFFECT IN PRACTICE.

The action of entomophagous insects varies in degree of usefulness according to their different habits of life and methods of reproduction. They are divided as predatory, *i. e.* those which devour other insects and their eggs, or the maternal body; or endophagous, *i. e.* those which enter the body of their victim destroying all but the outer husk, or which devour the contents while still retained in the abdomen or other specialised portion of the female body.

Some, moreover, entomophagous insects which feed exclusively on one species of victim; others, on the contrary are polyphagous and devour victims among several species, either related or not, of other species.

According to the mode of reproduction, the useful effect varies according to the fecundity of the species, *i. e.* according to the number of generations multiplied in a given number of feminiparous eggs. Further there must be taken into account the number and efficacy of the different adverse factors for the entomophagous species. I have often compared the different efficacy of entomophagous insects in relation to their different modes of life and reproduction, and have always concluded that the most useful in regard to destruction of numbers and therefore the most useful in regard to species injurious to agriculture are those which prey exclusively on one species, and which have themselves few enemies and few factors of competition for their survival. Next to these I rank the polyphagous endophagous insects, or those which are themselves subject to severe competition, and thirdly the predators with special victims and fourthly the polyphagous predatory species. The degree of prolificness of the different species categories, although not sufficient to alter their established order of utility, nevertheless forms a marked gradation within the categories.

In mind the different conditions stated above, I will now enumerate the different systems of control by means of entomophagous insects that have been followed hitherto with the object of discovering the reasons for their results in practice, and of seeing what may be expected from the different means of control against harmful species hitherto subject to special control.

Entomophagous insects with useful action in the absolute sense (insects injurious to agriculture). — For an insect to be useful in the sense implied above depends not only upon its own particular

nature (*i. e.* an endophagous species parasitising a definite victim, of low fecundity and little exposed to definite adverse factors) but on the victim itself, which, being very prolific, amply withstands the limiting factors.

Nearly all insects of small size come under this category, and we know that it is owing to their small size that such a high fecundity is required. Further, they are often polyphagous or they lack other expedients for preserving the species as a compensation for smallness and the often insufficient means of defence of the body. Against these it is the entomophagous insects of the first category which have the greatest effect and which constitute the chief check on excessive fertility.

Scale insects, Aphids and the other plant-feeders are examples of this class, consequently if their special enemy is an entomophagous insect, exempt from adverse factors of too active a nature, this latter becomes the absolute controller of the multiplication of the phytophagous species.

The effect of the entomophagous insect has been clearly demonstrated in cases where an injurious species has been combated by placing it in contact with its particular endophagous species. Where injurious species have been imported into new regions from which their chief enemy has been excluded, they have been free in consequence to exert their full activity, the adverse factors being almost completely inadequate. Such insects have been able to multiply to an excessive degree for a certain period, thereby proving the inadequacy of our artificial means of control. The intervention of the species which is their special enemy has proved the practical importance of these auxiliary insects for the protection of plants, the pest having been reduced to proportions which, from the cultural point of view, may be regarded as insignificant.

The two most striking examples in this sense are provided by *Noris cardinalis* against *Icerya purchasi* and neighbouring species, and by *Phaenocarpa berlesii* against *Diurys pentagona*. These two auxiliary species have been spread beyond their native confines, at the expense of hibernian species which at some previous time had made the same journey; they have been spread, and this is important, exempt from their particular enemies, with which no doubt they have to contend in their native country.

Noris cardinalis and *Icerya*. - This famous example is of an insect which, by devouring the eggs contained in the ovisacs of the mother, encompasses the complete destruction of the redoubtable pest and allied species (*I. aegyptiaca*, etc.). It was RILEY, in 1888, who first thought of utilising the natural enemies of this scale, then very widely distributed in California to the great detriment of the citrus groves. The same RILEY sent KOEBELE to Australia where he found the valuable *Noris* and sent it to California. Its wonderful action was immediately apparent for wherever this species was imported (and the same thing still holds true) annihilated, after only a few weeks, the biggest invasions of *Icerya*.

1892 (1892) *Noctus* was introduced into the Hawaiian islands (after an unsuccessful trial in 1890); in 1900 it was introduced into Florida, into Porto Portugal; in 1901 into Italy, in 1907 into Syria and in 1895 into Japan, in this latter case against *Icerya aegyptiaca*; in 1912, it was introduced into France, in the neighbourhood of Nice.

At the present time, *Icerya purchasi*, which before the discovery of *Coccinella* was considered a very great menace to citrus crops, has lost any agricultural importance whatever.

But the Coccinellid behaves more like an endophagous species than as an epiphyte. Its fecundity is greater than that of its victims, nor has it any special sites of special enemies in the localities where it has been introduced in the expense of *Icerya*.

Prospaltella barkesi against *Diaspis pentagona* (1).—If one takes into account the enormous difference in size and consequently in the number of specimens of *Diaspis pentagona* which, in comparison with *Icerya purchasi*, find room on a plant, and also of the number of plant hosts, which exceeds 50, many of which are wild, whereas *Icerya* has only three and these either cultivated or rare, it is easy to see that *Prospaltella*, which consists in outnumbering its victim, is much more efficient than that of *Noctus*; it is, no matter for astonishment, therefore, that *Prospaltella* requires, in order to get the better of its victim in a certain period of time four or five times as long. However that may be, it is eventually fulfilled just as completely.

Prospaltella barkesi, discovered, in 1906, by Berlese on *Diaspis pentagona* (*oryzalis*) from North America is the direct descendant of the species from China and Japan, especially the former, reduced to insignificant status, from the agricultural point of view, *Diaspis pentagona*, native of those countries. From 1906 onwards, *Prospaltella*, which at first was only found in the Far East, South Africa (Cape of Hope) and United States, has been distributed throughout almost all of Italy, Austria and Switzerland; more recently in Spain, the time Uruguay and, at the present moment, it is being forwarded to China. In 1913, the Government of the Argentine Republic distributed about its territory 1½ million batches (2) of *Prospaltella* derived from the consignment sent from Italy in 1909 and those immediately follow.

The facility with which this little wasp becomes acclimatised has been found in every country into which it has been introduced. In those localities where it has been established for more than two years the destruction of *Diaspis* from the agricultural point of view is very marked and it works as well and equally quickly everywhere. *Diaspis pentagona* so destructive to mulberries, pear and other fruit trees, and also to forest trees and ornamental plants, has also lost all economic importance.

(1) The article by Prof. Berlese entitled "The Control of the Japanese Fruit Scale", *Entomologist*, Italy, B. May 1913, pp. 167-171.

(Ed.)

(2) Each batch consists of a small twig on which is a cluster of the scale insects.

(Ed.)

Possibly in this same category should be placed the endoparasitism (or oodophagy) of *Perkinsiella saccharicida*, the little Fulgorid of American origin which caused such serious damage to the sugarcanes in the Hawaiian Isles, before Koebele and Perkins introduced there (in 1904) several species which preyed on its eggs. Among these oodophagous insects, the activity was shown by two species of *Anagrus*, two of *Praon*, one of *Optabilis*, *P. perforator* and by *Ooctrasticus beatus*. However, the latter named do not specially attack the eggs of *Perkinsiella*.

The beneficial effect of all these insects combined, at the expense of the Fulgorid, is, however, not such as to allow of an exact comparison with the two preceding cases. The reason is possibly because we are dealing here with one *special* insect but with several, and undoubtedly the multiplicity of host-forms is an advantage to the victim.

It is easy to understand that the beneficial effects of these various auxiliary insects is diminished by the intervention of other enemy or phagous insects.

In every locality where *Novius cardinalis* has been introduced, it has been exempt from enemies, hence its extraordinary success. Similarly with *Prospaltella berlesci*, which before being spread through Italy, was carefully freed from several species of Chalcididae, its endoparasitoides sites. Some scale insects, however, recently imported into Italy, *Rhizobius lophanthus*, which has luckily only been able to spread over some parts of Italy, owing to the climate, seems to hinder the action of *Prospaltella*; *Diaspis pentagona*, by devouring along with the scales, the young of *Prospaltella* contained thereunder. At the Cape of Good Hope *Rhizobius* occurs, the action of *Prospaltella berlesci* is also less energetic than in Central Europe where the climate does not allow *Rhizobius* to become established. TOWER, who discovered *Prospaltella* feeding on *Aspidiotus perniciosus*, definitely accuses the Coccinellid which preys on the same scale, of causing considerable damage to the phagous species in this way (1).

2. *Entomophagous insects of mediocre efficacy and intermittent action.*—This second category includes insects whose effective action is less energetic, constant and less uniform. The reasons for this are because they are themselves combated by certain entomophagous species or by other natural factors, or because their victims are chiefly controlled by other special insects, and consequently their increase or diminution does not depend on the entomophagi, or because they are polyphagous (or better polyxenous, i.e. feeding on numerous hosts). It follows that if these latter find themselves in consonance with the other enemy factors acting on the victim the beneficial effect is nil, or in any case such action as there is cannot be attributed to the entomophagous insects.

(1) Berlese and Paoli have recently discovered (24th. Feb. 1906) in Macedonia a new Chalcidid (*Prospaltella lomonosovi*) which destroys a very high percentage of the eggs of *Aspidiotus perniciosus*, a scale which in Italy and elsewhere does great damage to a large number of plants, particularly citrus. They have already taken steps towards introducing it into Italy.

An example is afforded by the species of *Scutellista*, belonging to the genus which behave as endophagi at the expense of species of *Lecanium*. In reality they are oocetophagi, that is to say they devour eggs after they have been laid, but while they are still being carried beneath the body of the mother, in the same way as *Novius cardinalis* devours the eggs of the larvae of *Icerya*.

The principal cause of the excessive development and consequently of the damages caused by certain species of *Lecanium* (at least by *L. aspidiotum*) is the condition of the plant host, as we already shown, and the action of the part of oophagi is only very secondary; *Scutellista cyanica*, for example, can never cope with the large and sudden invasions of *Saissetia oleae* or *Aspidiotus* (*C. msei* and *C. sinensis*). The above *Scutellista* was introduced, during the last ten years, into North America (it was forwarded by the Royal Station in Italy) and acclimatised there in 1900. CRAW also acclimatised it in the Hawaiian Isles (1905) with the same effects already noticed in Italy. It is too much to expect, therefore, that any of the other insect enemies of *Saissetia oleae* discovered or acclimatised in localities from which they were introduced, which may be discovered in the future, will have the same completely effective action as is seen in the cases of *Novius cardinalis* and *Scutellista*.

However, *Scutellista cyanica* is considered as a great destroyer of *Lecanium* in those parts of America into which it has been imported. According to Quayle, it destroys in California from 75 to 80 per cent of the eggs. At the same time it does not suffice to check excessive multiplication of the scale when the conditions of the plant host allow this maximum development.

Among entomophagous insects tested as controls of *Saissetia oleae* in various parts of the globe, though with no better results than those quoted, a large number of endophagous Hymenoptera should be mentioned: the minute *Hymenocyrtus cravii* Ashm. imported from Australia into France by COMPIÈRE; *Tomocera californica* How.; *Myiameles comberi* and other species of *Scutellista* in addition to those already cited. Numerous species of Coccinellid predators, such as *Rhizobius chalcidius* Muls., *Oreus australasia* Boisd., *O. chalybeius* Boisd. etc. as well as Coleoptera, *Talpocharaxes cocciphaga* Meyr. and *T. scitula* Rbr.

We thus have a case where, instead of adopting natural means of control and new and special entomophagous species, it is necessary to employ artificial methods, either direct or indirect, which result in the elimination of the fundamental cause of disease in plants, i.e., the state of the plant allows of the multiplication of the *Lecanium*.

On the other hand, the special endophagi of other species of *Lecanium* are oocetophagi for *Lecanium persicæ* and *L. hesperidum* and *Conys*. In the latter of the two foregoing, various endophagi for *Pulvinaria* can be seen to be actually the most efficient factors in the reduction of this reduction is only a very small one) of these species, which otherwise be extremely injurious here at home, in the same way as

numerous foreign species of *Lecanium* would be for plants of the country.

In this category of entomophagi of mediocre efficacy should be included, generally speaking, all Coccinellidae and other predators of Phytophthires or other larger insects belonging to other orders.

Generally speaking, predators, that is, the true *ectophagi* are not efficient as destroyers of other insects, either because they are easily combated by other entomophagi or because they are usually polyphagous. Nor do they persevere till the last individual of the victim species is destroyed, as the endophagi do, but, when food begins to become scarce, they migrate.

This is the reason why species combated by predators though usually subject to periods of great destruction, also have intervals where they multiply very rapidly; and in these later cases, those which feed on plants and fruit can be very injurious. Thus, the action of predators alone is not sufficient to check big invasions of any of the victimised species, provided these latter are sufficiently polyphagous.

Some species, however, seem as a rule to be more active than others. For instance, many testify to the great efficacy of a Coccinellid, *Lecanium montenazieri*, from Australia, introduced by KOEBEL into California against various scale insects belonging to the Coccidae and Pemphiginae (*Pseudococcus*, *Lecanium* and allied genera *Pulvinaria*, *Aspidiotus*, *Rhizococcus*, etc.). The same species, however, introduced by SILVESTRI against the above groups of Coccidae, did not give results of any appreciable nature. Numerous species of Coccinellidae of the genera *Rhizobius*, *Lepidococcus*, *Trithonyx*, *Seymus*, *Chilocorus*, *Pentilia* and the most polyphagous *Oncus chalybeatus* introduced in large numbers, chiefly into California in order to combat several very injurious species of scale insects (particularly *Aspidiotus perniciosus*), have not given good results; these cannot be even compared with those obtained by *Noctus* and *Pentilia*. Even in Italy, where some of the above species with the best results were introduced by SILVESTRI against native scales, no noticeable results accrued from their use.

Aspidiotus perniciosus, a great enemy of our fruit growing in California, has been controlled hitherto (apart from spraying methods) by the importation of entomophagous insects, both predators and endophagous. The United States entomologists who have done most in this respect have been inducing naturalists into every region where the scale existed or was likely to exist. Nevertheless, the specific endophagous species, the one rendering the terrible pest really impotent, has not yet been described. It seems that with the aid of the numerous endophagous species, polyphagous however, which exist in California and which absorb *Aspidiotus perniciosus*, this scale may prove, under certain conditions, less injurious. FERNALD (1914) states that these predators destroy some as many as 60 per cent of the scale insects, but at the same time that they are sufficiently numerous to be able to continue the invasion in a serious manner.

the species of endophagi which fight the terrible scale in greatest numbers are the following (among the Chalcididae): *Prospaltella perniciosus* Tower, *Aspidiotus pennsylvanicus* How., *A. diaspidis* How., *Signitera nigrita* Ashm., *Aspidiotus californellus* How.. The two last species are of small importance, but they bring the number to 8 species! But the percentage of parasitism of the large number of Hymenoptera attacking the scale, is small. According to HODGKISS and PARROT, (1914), to 35 per cent; and must still be employed, therefore, as a means of defence.

PARROT, who discovered *Prospaltella perniciosus*, states (1914) that this insect is very active in Massachusetts, Pennsylvania and Colombia against the terrible scale and would be still more so were it not for the action of numerous Coccinellidae, which attack the *Aspidiotus* in great numbers. However that may be, the action of this species of *Prospaltella* is very far from being as effective as that of *P. berlesii* against *Diaspidiotus perniciosus*.

Among Coccinellidae, *Pentilia misellæ* appears to be the most active against *Diaspidiotus perniciosus*.

An example afforded by this scale is one of the best for showing the action of a number of entomophagous insects on a single host species, and is therefore not the special endophagi of the particular victim.

Several entomologists have also tried for use against Aphids and particularly against *Schizoneura lanigera*, the acclimatisation of numerous species of Hymenoptera imported from New Zealand and Australia, belonging to the *Chalcidella*, *Colcophora*, *Leis*, *Mela*, *Verania*, *Scymnus*, *Hippodamia*, etc. The results have been of no practical value. *Hippodamia convergens* is the most numerous and most widely distributed species in North America.

PARROT (1914) calculates that in Oregon it forms from 50 to 60 per cent of the population of the Coccinellids of this State.

The introduction into Italy for use against Aphids has not given results of appreciable value.

Schizoneura lanigera, which causes such great damage to apple trees in this country and which is one of the most redoubtable species of Aphids, is not combated by any insect, either among predators or endophagi.

The waxy protection with which this Homopteran surrounds itself and the occurrence of a root-infesting form (*radicicola*) are sufficient to protect the species sufficiently and to afford it a practical security which it is difficult to overcome.

Aphids are most strongly attacked by endophagous species, e. g. those belonging to the group of the Braconidae, which sometimes decimate their hosts and even wipe them out completely.

The practical activity of predators is still less marked against insects of this group and usually of greater dimensions than the Phytophthires. On the other hand, the activity of endophagous insects is frequently most marked and often providential in character, especially that of those due to the Hymenoptera and Diptera. Nevertheless, their action is always a constant one, and is not sufficient to prevent the periodical attacks of the pests.

This is the case, for example, with all the species which have been introduced from Europe and Asia, Bombycidae and other Lepidoptera, diurnal and nocturnal. In our own country, the large cabbage white butterfly (*Pieris brassicae*) is, though vigorously combated by numerous endophagi, both insects and caterpillars (more than by predators), is still classed as one of the most injurious species. For the allied species, *Pieris rapae*, in America, the imported *Apanteles glomeratus* from England, but with no effect, is used, as in Italy. In such cases even if a species is absent from a certain region, its place is taken by an allied species of exactly similar habits.

A remarkable campaign has been undertaken by United States entomologists against *Limanthria dispar* and *Euproctis chrysorrhoea*, two of the most injurious Bombycidae in our own country, which have recently been introduced into North America.

HOWARD, particularly, has introduced and acclimatised insects from 1901 onwards, all the endophagous insects, from Europe and Asia, belonging to the above species. The result, doubtless an approximate one, will be to reduce the damages caused by this species in the same manner as has been accomplished in Europe, where the two moths, of the former, put in appearances which, though serious in extent and damage, only occur over fairly long intervals of years. Undoubtedly, the intervention of all these enemy organisms, which act as a brake on the species, their presence in America would have been insupportable, the destruction of numerous species of shrubs and other plants which are attacked. On the other hand there is no ground for hope that, even if the two species may be rendered definitely harmless through their insect enemies.

In addition to large Coleoptera, such as *Calosoma sycophanta* from Europe, now well acclimatised in America at the expense of the mentioned Bombycidae and especially of *L. dispar*, numerous other endophagous insects have been imported on various occasions and acclimated for the same purpose. The results obtained have been given in the United States publications. Numerous Tachinidae from different parts of the globe have given useful results: *Blepharoripa scutellata* and a species of *Crossosomina*, etc.

Chalcidids parasitic on the eggs of *L. dispar* have been imported from Japan, *Schedius kincanae* How, *Anastatus bifasciatus* Fons. Along with these, however, has been introduced *Tyndarichus lucorum*, a hyperparasite of *Schedius* and possibly also of the other species.

Predators and endophagi from various parts of the world have been introduced to combat other injurious species of Lepidoptera in the United States. *Apanteles lacticolor*, *Meteorus versicolor* and *Calosoma sycophanta* were introduced in 1905, in Maine against various Lepidoptera and, later, a Tachinid and two oophagous Chalcidids already mentioned.

Braconidae and Tachinidae were introduced into British Columbia in 1914 at the expense of *Heliophila unipuncta* and of *Plusia gamma*. *Calosoma sycophanta* was introduced into Sumatra in 1913, against *P.*

Heliothis obsoleta. The Director of the Deli Proet-
ings highly of the effects of this importation.

In 1909-1919, a Chalcidid, *Trichogramma (Pentartaron) carpocapsae*, was introduced into Turk-istan against the *Carpecapsa* of the
with poor effect, the extent of parasitisation not exceeding

species of entomophagous insects have also been tried against
which damage the cotton plant in America, but with compara-
satisfactory results, etc. etc.

Attempts have been lacking to introduce into various regions endo-
to combat injurious species belonging to other orders, in
obtaining useful results.

Those which seem to have been most successful in this direction,
Phaenocarpa sphenophori) merits attention. This is an endophaga-
the weevil attacking the sugarcane (*Metamasius hemipterus*);
it was introduced into Honolulu and (according to SWREY) gave excellent
results, many as 87 per cent of the injurious insects being destroyed.

Naturalists speak very highly of the parasites, some of which
reported, of *Anthonomus grandis*, which is considered as one of
the great pests of the cotton plant, but the nature of its effect has
not definitely fixed.

SHAYESTRI has also been introducing for several years past, at
one of our terrible *Dacus oleae*, several species of Hymenopteran
collected in Australia, South Africa, North Africa and more re-
cently in India. The first batches were without effect; the effect of
subsequent introductions is still being awaited and a certain amount
is ascertained, although, in my opinion, the olive fly belongs to the
insects which, in nature, has its increase limited by factors quite
different from those of entomophagous insects.

In conclusion, it is unreasonable to hope that an endophagous insect
imported into a new locality can succeed in neutralising the effects of an
injury species indigenous to that locality, unless there is reason for cred-
ing in the existence in the world of a region where the said species, though
nowhere, is agriculturally harmless. If so, it is in this region
the fundamental cause of this desirable state of affairs should be
found. It is quite possible that this cause may prove to be an entomo-
phagous insect.

The importation of enemy forms of an injurious insect is, however,
not without danger. The fact must not be lost sight of that in these
insects one may often be dealing with double-edged

It has been said that the factors adverse to organisms are generally
of natural origin, and harmful species of insects are not exempt from

It may thus happen that the importation of a species, even an
injury one, disturbs a certain state of equilibrium, by means of
the injurious form leaves room for a truce, precisely on account of
natural checks.

In this latter category, therefore, occur a large number of non-useful species of no practical value—at least not to the point of saving from destruction. It is among this great army of species, only a few superficially useful, that the entomologist, aided by the light of common sense and sound logic, must pick his way, not allowing himself to be led astray by false hopes. Generally speaking, it may be said that the study of the habits of a species, or of its allied or closely related species, immediately produces data, which latter enable a conclusion to be drawn by means of the most likely arguments as to whether it is possible to admit that the species is an enemy organism capable of diminishing its numbers. In such cases, if it is worth while to have recourse to natural methods.

It is evident that, in many cases, natural control can never be of great artificial value. In such cases it is better to avoid waste of time in the use of artificial methods.

According to premises based on present knowledge which, by future experience might well show to be false, it seems that certain species of insects, which attack some very injurious species with considerable local success, might be introduced into our own country in order to try to control the same or allied species which cause similar damage.

For example, certain species of Diptera (*Sarcophaga cimbicoides*, *S. hunteri*, Hough, and others), which are said to be very efficient in the United States against Acrididae (*Melanoplus*), should have similar success against the locusts in our own country.

A Chalcidid (*Telenomus ashmeadi*) destroys, in America, large numbers of the eggs of an injurious bug, *Pentatoma ligata*, and neighbouring species, and a Tachinid also attacks the adults. It is therefore feasible that a Hymenopter should at least display a certain activity against certain Pentatomidae which are so difficult to control by artificial means and little combated by other predatory or parasitic insects.

Lepidosaphes bekii, the purple scale of the citrus, has no efficient parasite in our country. Recently, PORRER has stated that in California occur a Coleopter and Hymenopter which are strongly hostile to this species.

Similarly, certain Tachinidae belonging to the genus *Adoxophora* are in America, efficacious parasites of Tipulidae; one has only to think of the damage certain species of Tipulidae cause in our rice fields.

The midges of wheat (Cecidomyiidae) and of other plants have many species of Hymenoptera as their enemies, e. g. a *Pentapleura* which appears to be very useful against *Mayetibola destructor*. It is probable that several species of these endophagous insects might succeed in controlling the wheat midges at the expense of indigenous midges.

The field is a vast one; and, so far, practically unexplored. The agricultural entomologist will render efficient service if, rather than proceeding at haphazard, he brings his reason and the necessary biological knowledge to bear, especially with regard to those species which he wishes to control with the help of auxiliary insects.

SECOND PART. ABSTRACTS

AGRICULTURAL INTELLIGENCE

GENERAL INFORMATION.

The Field and Forest Resources of British Guiana.—HARRISON, J. B. and RAY,
K., Department of Science and Agriculture, British Guiana, in *The Journal of
Agriculture of British Guiana*, Vol. VIII, No. 34, pp. 208-233, Demerara, Sep-
tember, 1910.

DEVELOPMENT
OF
AGRICULTURE
IN DIFFERENT
COUNTRIES

AREA AND POPULATION.—British Guiana covers an area of 57,700,000
acres, but only about 2,000,000 acres are alienated from the Crown.
The remainder, 9,000,000 acres are easily accessible for cultivation. The
population at present estimated at 70,419 of which 14,000 are European
(10,000 Portuguese) and the rest East Indian, Chinese, Aborigines
&c.

The East Indians are associated with the sugar estates and rice
fields on the coastal lands while the forest industries and gold and
diamond mining are to a large extent carried on by persons of the African

race. — The mean annual rainfall near the coast is about 94
inches and inland about 105 inches. The distribution is fairly even,
except in the inland districts.

The average mean shade temperature near the coast is 80° F. and the
annual range is about 19° F.

Soils. — The soil characteristics of the three great belts of the
country are as follows:

- (a) The alluvial coast belt is of exceptional fertility and its soils are
the richest and most fertile in the tropics.
- (b) The belt of the lower hills and plains covered with inexhaustible

forest lands is of less agricultural value, the soils being mainly sandy. The regularity of the rainfall, however, enables arboriculture, such as limes and Para rubber to be grown successfully.

3. The savannah belt is as yet undeveloped and consists of alluvial and fluvatile soils of considerable fertility.

LAND TENURE. *a)* For the cultivation of permanent crops, such as rubber, citrus, coconuts, etc.

No rent is payable during the first five years of the lease; from the 6th to the 10th year inclusive the annual rent is 25 cents per acre; for the remainder of the lease the rent is 80 cents per annum.

Each year for a period of seven years not less than 100 trees shall be planted and the cultivation shall be kept in good order to the satisfaction of the Governor-in-Council.

b) For the cultivation of other crops:

Crown land is granted under special circumstances for periods of 99 years or more at the following rates:

- 1) any area up to 5 acres, \$ 1 per annum;
- 2) areas from 5 to 100 acres at 20 cents per acre per annum;
- 3) areas from 100 to 500 acres at 15 cents per acre per annum;
- 4) areas above 500 acres at 10 cents per acre per annum.

LABOUR. — The demand for labour in the sugar industry has necessitated immigration from India a necessity. From 1901 to 1911 the annual immigration of East Indians was 2435. The wages for operations vary from 1/- to 2/- a day, cane cutters receiving 1/- to 3/6. Women earn from 10/- to 1/- and children 6d. to 8d.

CROPS. — *Coconuts*, sugar and rice are grown in the coastal zone, whilst cacao, coffee and rubber are grown on the river lands.

Sugar cane. — This is the most important of the agricultural sources of the colony. The area of land, 72 000 acres, under this crop is practically the same as it was 18 years ago, though the average yield is somewhat higher. Scarcity of labour is the chief factor hindering expansion of the industry. The export in normal years is 110 000 tons of sugar valued at £1,179,218 though it is estimated that the total available land suitable for sugar cultivation is capable of producing 2½ million tons annually. The "Bourbon" variety has been the source of "Demerara" crystals has suffered considerably of late from fungoid diseases and 4/5th of the area are now planted with varieties capable of higher yields but giving inferior crystals.

Rum. — British Guiana rum is produced by a rapid fermentation extending from 36 to 48 hours, of molasses diluted with water. Improvements on scientific lines has brought the process almost to perfection and the rapidity of the yeast fermentation other organisms are excluded so a less flavoured product is obtained.

Molascuit. — This consists of a mixture of the finer particles of the interior spongy tissues of the sugar cane, separated from the juice produced during the grinding of the cane. It is a dry, brown, solid

with a fragrant odour, containing 72 per cent of readily digestible constituents.

The development of this cultivation is due to the East Indian rice generally grown is a long-grained variety known as "Beri" and has apparently originated by unconscious selection. The variety is known as the "Berbee". The primitive Eastern method is generally practised, but modern appliances have recently been giving promising results. Two kinds of rice are made, a brown steamed variety and white rice. No rice polishing is carried out but rice-meal is a by-product and exported. The average yield per acre for 1912-13 was 22.2 cwt.

Coconuts. — The coconuts palms growing in the colony are scattered, but the cultivation over large areas is steadily taking place. They flourish in the light sandy loams of the coastal regions but they do not do well on the pegassy clay lands and on river lands away from the coast. The area under coconuts in 1915 was 15,200 acres, of which 10,000 has not yet come into bearing. The exports during 1915 averaged 1,427,644 nuts mostly exported to the United States. Large quantities of copra are made in the colony.

Both Arabian and Liberian coffee grow with exceptional success, the former is singularly free from disease.

The scarcity of labour tends to restrict the extension of the area under the Arabian variety which now reaches 3,800 acres. The Liberian variety is very hardy but often requires checking to prevent it from exhaustion. A large quantity of the coffee is consumed locally. The exports in 1914 reached 1,000 cwt.

Forastero. — The Forastero is the chief variety grown. Most of the crop is consumed locally so that the export is small. About 2,000 acres are under cultivation, but owing to lack of capital with the small farmers this promising crop does not extend.

Latex. — There are 5 species of *Salpicon* indigenous to the colony, of which only one yields rubber of marketable quality.

Para rubber from the wild forest trees was formerly exported as "Salpicon". Since 1907, Para rubber has been planted, and there are now about 450 acres under this cultivation. Tapping operations on a large scale are anticipated during the next year. It is estimated that a reasonable profit can be expected with rubber selling at 2/- per lb. The cost of supervision of the estates and the proximity of the United States are factors which should encourage the extension of this industry.

Cottons. — They grow well on the lighter soils if protected from the effects of the wind. There are about 1,000 acres under this crop and the best areas are of loose friable land and ferruginous laterite soils favourable to its cultivation. Selection experiments are being carried out to improve the yield of seed.

Other fibres. — Only the indigenous tree cottons are grown

with success. The lint is short-stapled and of similar quality to Peruvian worth *6d.* to *9d.* per lb.

Hybridisation experiments have been carried out with success producing a heavy bearing perennial variety with lint of this type.

Hedychiium coronarium, the Ginger Lily, is a promising crop. In an experimental plot a first crop of 22 tons per acre was obtained 10 months after planting and a ratoon crop of 27 tons was obtained 12 months after.

CATTLE RAISING.—Large areas of the coast land are used for cattle raising and there are about 90,000 head of cattle raised. The savannahs are scattered areas of well watered fertile land considered as specially well adapted to cattle raising.

FOREST RESOURCES.—The forests cover some 78,000 sq. miles, the workable area of which is confined at present to 11,000 sq. miles. The more important commercial timbers are given below:

1. Greenheart is the best known of the timbers and is used for merged works, such as wharves, piles, dock and lock gates. It is obtained from 10 to 25 inches square and 65 feet long.

2. Crabwood or West Indian Mahogany (*Carapa guianensis*)—a red variety is used for building purposes and furniture.

3. Wallaba "Soft Wallaba" (*Eperua falcata*) and "Hard Wallaba" (*Eperua founi*). A heavy resinous wood with unpleasant smell, used for posts, shingles, palings and vats.

4. Hard Woods: "Mora" (*Dimorphandra Mora*) for pillars; "Bullet tree" (*Mimusops globosa*); Surandanni (*Hieracium noides*); "Purple Heart" (*Copaifera pubiflora*); *Lochnera* (*Hymenocla Courbaril*); "Hackia" (*Siderodendron triflorum*); *Huoniria balsamifera*; Kakiralli (*Levythis corrugata*); Tonkin (*Myristica mitta*) (*Dipterocarpus odorata*); Hiawaballi (*Onchodendron Lambertii*); *Goupia glabra*; and Phokadie (not identified).

5. Soft Woods: Silver ball (*Nectandra* spp.); Hooback (*Myrcia guianensis*); Arrisourou (*Phenacarpus guianensis*); White Cedar (*Podium longipes*) and Red Cedar (*Podium altissimum*); *Simarouba* spp. (*Myristica surinamensis*) and Photee (*Jacaranda Copala*). The last obtained from *Ardisia nitida*.

Charcoal is also made for export to the West Indian Islands.

Forests products are: Gum Anini (*Hymenocla Courbaril*); *Podium heptaphyllum*; Sonari or Butter nuts (*Caracota*); "Crab oil" from seeds of *Carapa*.

207. **The Healthiness of Rice Fields in Italy.**—BORGOGNA, ORI-TELLI, *Scienze*, Year VI, No. 1, pp. 3-11, Verceili, January 15, 1915.

The writer shows that the cultivation of rice has no injurious effect on health nor on the vigour of the race, whilst it yields a much greater income per unit area than that of other more important and more cultivated crops. Making use of recent sources of information, he shows the progress and well-being from an economic, social and hygienic

Italy has derived from this cultivation and shows how devoid of foundation are the accusations against its unhealthiness. The exportation of rice has been a source of continually increasing revenue in the present crisis, as shown by the following figures:

Mean annual export in thousands of cwt.

	1880-1884	1885-1890	1891-1894	1900-1914
Wheat, <i>in sacks</i>	108	216	424	427
Rice, <i>in boxes</i>	0	728	1,128	884

1884 corresponds to a value of about one million sterling, in addition to the corresponding to the home consumption, obtained from a growing scarcely 301,000 acres.

The area under rice, however, has diminished during the last 20 years. It was more than 404,000 acres, in 1804 it was 408,000 acres and at the present time it reaches only 301,000 acres. The yield, on the contrary, has increased from 15,770,541 bushels = 6,211,000 cwt. in 1804 to 6,558,000 cwt. at the present day. The total yield has therefore increased by about 5 per cent and the yield per acre has increased still more, the actual being 15.22 cwt. per acre in 1804 and 26.53 cwt. per acre at the present time or an increase of 74 per cent. No other Italian crop can even compare with these figures, as shown by the following table:

Yields of cereals in Italy in 1880-1884 and in 1900-1914.

	Yield in cwt. per acre		Percentage increase
	1880-84	1900-14	
Wheat, <i>in sacks</i>	6,069	8,211	34.1
Millets, <i>in sacks</i>	10,78	14,427	34.1
Oats, <i>in sacks</i>	6,37	8,300	29.1
Rye, <i>in sacks</i>	6,48	7,772	19.1
Barley, <i>in sacks</i>	6,44	6,772	6.6
Rice, <i>in boxes</i>	14,50	26,600	84.1

While the other cereals require 20-25 per cent of the value of the crop for rice cultivation demands from 25 to 35 per cent.

Wheat at just over 12 s. per cwt. and paddy at 8 s. to 1½ d., so the value of the crops per acre excluding the milling is as follows:

	Value of yield	Cost of labour
	£ s. d.	£ s. d.
Wheat (8,211 cwt. per acre)	100 19 3	11 4 1
Rice (26,600 cwt. per acre)	11 16 2	11 2 1

These figures give some idea of the benefit to the cultivator from rice cultivation.

The effect of rice cultivation on the health of the inhabitants is shown by the greater diminution in the death rate from malaria in the districts between the Po and the Ticino in proportion to the increase in rice cultivation. The diminution in the death rate per thousand from 1875-1888 to 1902-1912 is shown by the following figures:

Districts	1875-1888	1902-1912
Novara	28.68	18.6
Vercelli	29.11	16.8
Pavia	24.09	19.6
Mortara	27.75	15.2

The writer compares these figures with those relating to the districts of the same region where rice is not cultivated and shows that the diminution in the mortality during the same period is about the same in these districts, though the former districts (e.g. the mountains of Savona) are considered to be very healthy.

Although rice cultivation is said to favour malaria and although fatal cases have been recorded, the disease is much less serious and is less prevalent in rice-growing districts than in other districts.

This is shown by the figures in the table below which compare the number of deaths caused by malaria in Italy during the period 1896-1898 when the method of prevention of the disease was unknown with the death rate in the period 1910-1912 when preventive measures were adopted everywhere.

Thus, of the total deaths caused by malaria during the triennial period 1910-1912, 5.5 per cent were in northern Italy and the remainder were in the rest of the country.

Comparison of the numbers of deaths due to Malaria in Italy in 1896-1898 and 1910-1912.

	Triennial period		Percentage diminution
	1896-1898	1910-1912	
Northern Italy:			
Piedmont	581	38	93.3
Liguria	65	12	90.9
Lombardy	822	96	88.6
Veneti	1,099	366	33.2
Emilia	607	101	16.6
Rest of Italy	42,601	19,595	24.8
Entire country	45,775	11,208	24.9

Further, the decrease was greatest in Piedmont, the greatest rice-growing district. There is therefore no truth in the statement that fields and malaria are inseparable.

The question of the effect of rice fields on the physique of the inhabitants is shown by the proportion of discharges from the army. During the quinquennial period 1880-1890 the percentage of discharged soldiers from rice-growing districts was equal to or a little less than those of the non-rice-growing provinces, whilst the percentages in the regions of southern

gases are almost unknown and where the malaria is of a much milder type, were much higher, almost double and even more in

CROPS AND CULTIVATION.

22. GASES. — LEATHER, I. W. (Imperial Agricultural Chemist), in *Memories of the Department of Agriculture in India, Chemical Series*, Vol. III, No 3, pp. 85-132 (Fig. 1-2). Calcutta, 1915.

SOIL PHYSICS,
CHEMISTRY
AND
MICROBIOLOGY

The determination of the composition of the soil gases, the amount of water vapour included as a means of indicating the source of the oxygen and carbon dioxide, and whether the latter had been merely liberated, or the fermentation of organic matter. The volume of gases in the soil was determined directly by the deflection of the writer's soil sampling apparatus, whereby the gas was extracted under reduced pressure from a given volume of soil. A special apparatus was devised for the determination of small quantities of oxygen and the ratios of oxygen to argon and nitrogen to argon were determined within 10 per cent.

Results of these investigations on Pusa soil and of the gases from other soils are as follows. The volume of gas in the soil as found by direct measurement is approximately equal to that obtained by calculation from the volume of the soil particles and water present. The sum of the volumes of the various constituents determined separately is usually somewhat less than the volume of the fresh soil, indicating a small condensation of water vapour on the soil particles, the volume of such condensed in the Pusa soil being less than 1 per cent of the total gas present. The volume of water vapour in soil by water is never exactly equal to the volume of water present. During the wettest weather the volume of gas only falls to 80 per cent of the volume present during long periods of hot dry weather. The gas from soil which has been freshly treated with farm manure is quite naturally contains a high proportion of carbon dioxide and a small proportion of oxygen but these proportions are somewhat modified by the action of the soil.

The composition of the gases in the neighbourhood of the roots of *Crotalaria retusa* and maize showed very high percentage of carbon dioxide (70.0) and low percentage of oxygen (2.3 to 4.5) and small quantities of argon (0.5 to 1.4 per cent). Although carbon dioxide is consistently liberated by the roots of higher plants there is no evidence to suggest that it is actually produced by lower organisms. The liberation of carbon dioxide must be due to the agency of an entirely different class of biological organisms from that concerned with the assimilation of oxygen or the liberation of carbon dioxide. Although the percentage of carbon dioxide in the soil is generally high, most of it is present in the dissolved state in the

The determinations of the ratios of oxygen and nitrogen indicate that the chief changes in the soil are concerned with oxygen, whilst nitrogen-assimilation or nitrogen-evolution in dry land is so limited that it is usually difficult to detect. On the other hand, like the gas from rice land, the argon determination demonstrates that most of the nitrogen is derived from the soil and not from the air.

The amounts of the gases diffusing into or out of the soil have been calculated on Buckingham's assumption that the quantity of gas depends upon the "porosity" or inter-space occupied by the gas. They show that the diffusion of the carbon dioxide is according to expectation, that the amounts of oxygen entering the soil are much greater than to be expected from the amounts of carbon dioxide or nitrate which are found concurrently. It is concluded that the diffusion of gases up to 12-15 inches is so efficient that soil cultivation for the purpose of aeration is apparently unnecessary. The well-established value of gas pressure must therefore be referred to other causes.

2109. — **The Activity of Soil Protozoa.** — Koch, G. P. (Research Fellow, New College), in *Journal of Agricultural Research*, Vol. V, No. 11, pp. 477-487, 1916, D. C., December, 1915.

These experiments were carried out to determine the conditions for protozoa in the soil and the conditions determining their excretion. A direct method of examining the soil microscopically was found satisfactory. In each case a small portion of the soil sample was placed on a glass slide and stirred with a few drops of tap water. The time the water and soil were mixed was noted and the examination completed in two minutes.

Twenty greenhouse soils were examined in this way. In all these cases active protozoa were found. In all these cases the soils were loose and their moisture content was much above their optimum.

Fourteen field soils were examined similarly and in no case were motile protozoa observed. Samples of standing rain water collected from logged soil always showed the presence of motile protozoa.

Experiments were then made with three soils incubated at different temperatures and with different amounts of moisture from 1 to 4 times optimum moisture content. No motile protozoa were found in one case, that of field soil containing 1½ times optimum moisture; in this case the soil showed a small depression in which a little water had accumulated; increasing the water to 2 and 2½ times optimum resulted in the appearance of motile organisms at all temperatures 5.0° C. in each soil. It is therefore concluded that moisture is an important factor determining the excretion of the protozoa.

Attempts were then made to determine the length of time for the excretion of the organisms. The shortest period of incubation was between 2 and 3 hours at a temperature of 22° to 24° C. for the small flagellates, whilst flagellates require from 6 to 8 hours and large ciliates from 12 to 24 hours. Thus the microscopic examination of the soil under water for a period of two minutes will show only the presence of the active protozoa which

Experiments in Disinfecting Marshland in Germany. NOSSELT A., in *Landwirtschaftliche Jahrbücher*, Vol. 48, N° 4, pp. 587-597, Berlin, October 20, 1918.

By irrigating marshy soil with disinfectants (carbolineum etc.) the yield of grain is increased to a great increase in the yield. This increase was more marked when the disinfectant had been applied some time before sowing than when it was applied later. The best return was obtained by the use of from 50 to 100 carbolineum per cubic metre. A carbolineum rich in volatile substances increased the yield more than one containing less. Its action is due to the destruction of the number of bacteria and Nematodes in the soil.

Blueberry Culture as a Means of Utilizing Acid Soils. (1) GOWEN FREDERICK, in *Proceedings of the Entomology, Horticulture, and Agriculture Society*, N° 133, 12 pp., XVII, plates, Washington, D. C., 1918.

OPENING
UP LAND FOR
CULTIVATION

Swamp blueberries, the best of which, for cultivation, is the swamp blueberry (*Vaccinium corymbosum*) require:

1. An acid soil, and they thrive best in that particular type of acid soil which consists of a mixture of sand and peat.

2. Good drainage and thorough aeration of the surface soil and a permanent but moderate soil moisture. Under such conditions the mycorrhizal root fungus which is believed to be essential to the nutrition of the plant develops freely.

3. Varieties liable to late spring frosts should be avoided, for while the young plant itself is seldom injured by freezing, its crop of fruit is often killed in this way.

4. The present the best way of propagating the swamp blueberry is by cuttings from the best wild bushes. Grafting and especially budding are unsuitable for commercial plantations because blueberry bushes are content with sending up new shoots from the stock.

5. A single wild plant can be divided into as many as 30 plants each with a small portion of the root mat, and, by utilizing the various methods of propagation (cuttings, rooted shoots, root cuttings etc) as many as 600 plants can be made from a single very large wild bush.

6. Cuttings from cuttings or rooted shoots are ready for a permanent field plantation when they are 1 or 2 years old and 6 to 18 inches high. As some blueberries are almost completely sterile to their own pollen, it is important that a plantation should not be made up wholly from cuttings from one stock. Several stocks should be used in alternate rows. In the permanent plantation the bushes should be set 8 feet apart each way. The ground should be ploughed to a depth of about 8 inches and repeatedly harrowed or otherwise tilled during the season preceding the planting, in order to keep down all competing vegetation. The tillage of the plan where the young bushes have been set should be shallow and it is recommended to be followed by a small light spring tooth cultivator with the teeth set closer together than usual.

7. In case of drought, subirrigation may be used on perfectly level ground,

but on uneven areas surface irrigation, if accompanied by good drainage, is preferable.

Fertiliser experiments have shown that lime is positively injurious to blueberry plants, and that stable manure, while producing a temporary stimulation of vegetative growth is likely to cause serious damage. An acid mixture of the following composition, at the rate of 150 lb. per acre is recommended:

Per acre

Acid phosphate (high grade, about 16 per cent available phosphoric acid)	100
Sulphate of potash (50 per cent potash)	50
Sulphate of ammonia (20 per cent nitrogen)	50

This and similar acid mixtures have been used with success on blueberry plants in both pot and field experiments. However, as it is required to make swamp blueberry fruit abundantly and cheaply in suitable peat and sand soils properly handled, the use of fertilisers in commercial plantations is not at present advocated.

The plants in field plantations come into bearing when 2 to 3 years old (in greenhouses they often ripen a few berries in less than a year). The bushes of the swamp blueberry often live 50 to 100 years bearing fruit.

A plantation near Elkhart, Indiana, about 2 1/2 acres in extent, between 1910 and 1915 when it was 21 to 26 years old, the following yields and receipts:

Average yield per acre	1,711	qt.
at price per quart	11 1/2	cents
receipts per acre	\$	213.44
profits per acre	\$	116

The expenses were:

Weeding, cultivation and irrigation	\$	20	per acre
Cost of picking		0.05	per quart
General cost of maintenance of equipment		2.00	per acre
Interest		12.00	
Taxes		2.00	
Depreciation or sinking fund		4.00	per acre

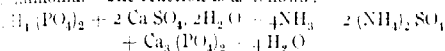
This plantation was made by transplanting wild bushes with selection as to productiveness or size of berries. With selected variety yield should be greater.

Conclusion:—The introduction of the blueberry into agriculture has a much more profound significance than the mere addition of a new agricultural industry to those already in existence. Blueberries grow best in soils so acid as to be considered worthless for ordinary agricultural purposes. Their culture, therefore not only promises to add to the welfare through the utilization of land almost valueless otherwise, but offers a profitable industry to individual landowners in districts where

under cultural conditions are especially hard and unpromising, and it is the possibility of the further utilization of such lands by means of manures adapted to acid conditions (1).

The Absorption of Ammoniacal Gas by Superphosphates and the Use as Fertilizer of the Phosphates thus obtained.—GERLACH, in *Zeitschrift für anorganische Chemie*, Vol. 14, pp. 13-14, Leipzig, January 11, 1919.

Ammoniacal gas on passing over fresh or dried superphosphate is readily absorbed by this fertiliser with the production of heat. One molecule of superphosphate absorbs 4 molecules of ammonia gas. Owing to the ammonia contained in the superphosphate, other transformations take place, in which the final products are insoluble phosphate of lime and free ammonia. The reaction is as follows:



It is probable that double salts are formed as intermediate products in this reaction is only complete in an aqueous medium. Theoretically, 100 parts of phosphoric acid (P_2O_5) absorb 30.4 parts of ammonia-gas.

In the experiments, the writer used finely ground fresh superphosphate. On passing a current of ammonia gas over this in a revolving drum, a great part of the gas was soon absorbed. This absorption set free enough of the water in the superphosphate entirely evaporated and the residue remained in the drum an amorphous dry mass, easily reduced to powder. The unabsorbed ammonia gas can be used to repeat the process. In order to obtain sufficient of the fertiliser for a manual experiment, the superphosphate repeatedly treated varying quantities of superphosphate (10-12 g.) with ammonia gas. It is considered that the process could be carried out industrially.

The following is the percentage composition obtained by passing 100 g. of ammonia gas over 3 kg. of superphosphate:

Microscopic	3.42	Total sulphuric acid	10.92
Monobasic	7.15	Sulphuric acid soluble in water	24.48
Dibasic phosphoric acid	16.74	Oxide of iron and alumina	1.48
Phosphoric acid soluble in water	1.13	Substances insoluble in hydrochloric acid	4.26
Phosphoric acid	24.78		
Insoluble in water	3.34		

With the help of these data, the following percentage composition can be calculated:

Microscopic water	3.42
Sulphate of ammonia	34.74
Dibasic phosphate	2.73
Tricubic phosphate	39.19
Sulphate of lime	22.55
Phosphate of iron and alumina	2.96
Insoluble substances (silica etc.)	4.26
Total	99.74

On this subject: *The Agricultural Utilization of Acid Lands by Means of Acid Manures*, United States Department of Agriculture, Bulletin, No. 6, 1913.

(Author's note).

MANURES AND MANURING

100 gms. of soda	15.0
100 gms. of lime	12.0
100 gms. of lime } Norwegian sulphate	14.8
100 gms. of ammonia nitrate	31.8
100 gms. of ammonia sulphate	26.8
100 gms. of ammonia chloride	28.3
100 gms. of urea	39.4
100 gms. of nitrate of urea	31.0
100 gms. of potassium nitrate	13.7

along with the double sulphate of ammonia and soda and ammonium chloride pot. experiments have been made. From the results of the experiments, the writer draws the following conclusions:

1. Ammonium chloride has the same productive value as ammonium sulphate. The double sulphate of ammonia and soda, has according to pot. experiments, the same effect. Both these fertilisers can thus be replaced by ammonium sulphate.

2. Ammonium nitrate, urea and nitrate of urea generally give the same results as sulphate of ammonia; in some cases, they are even equal to ammonium sulphate. Urea, and perhaps nitrate of urea, alone have any practical value. Ammonium nitrate is hygroscopic and readily explodes.

3. Sodium may give the same results as the preceding, but it is only useful when the weather is very dry during the chief growing period. It must be admitted that its productive value is a little lower than that of the above fertilisers.

4. Nitrate of lime has the same productive value as nitrate of soda, but more hygroscopic, which decreases its usefulness. Potassium has less productive value than sodium nitrate.

Recent Investigations of the Action of Manganese on Plant Growth (1). — *My* (1915) in *L. Stazione sperimentale agric. italiana*, Vol. XLVIII, Part. 10-11, pp. 105-115. (Milano, 1915).

1. *Pose*. On the Biochemistry of Manganese: the ratio of Manganese to Iron in Vegetation. — *Reale Istituto d'incoraggiamento di Napoli*, 1915) has shown that there is a definite optimum ratio between iron and manganese in vegetation, and that the failure to recognise this fact probably accounts for the inconsistency of the results obtained with manganese as a manure.

2. *Pose*. Into account the facts observed by *MEXOZZI* concerning the chemical reaction of the manganese salts with other compounds (1914), and also the effect of the added acid radicle, especially the sulphate, the writer carried out experiments with sodium sulphate in addition to sulphate of iron and manganese in quantities containing equivalent amounts of sulphate.

3. *Conclusions* of these experiments are as follows:

(a) The addition of sulphate of soda or of sulphate of manganese alone does not give any advantageous results.

(1) *N. S. Agric.* June 1911, N° 170-1; also *R. Ist. N.* 776, *R. Ist. N.* 613, 717, 983, *R. Ist. N.* 1015, 1016, 1017, 1018, 1019, 1020, 1021, 1022, 1023, 1024, 1025, 1026, 1027, 1028, 1029, 1030, 1031, 1032, 1033, 1034, 1035, 1036, 1037, 1038, 1039, 1040, 1041, 1042, 1043, 1044, 1045, 1046, 1047, 1048, 1049, 1050, 1051, 1052, 1053, 1054, 1055, 1056, 1057, 1058, 1059, 1060, 1061, 1062, 1063, 1064, 1065, 1066, 1067, 1068, 1069, 1070, 1071, 1072, 1073, 1074, 1075, 1076, 1077, 1078, 1079, 1080, 1081, 1082, 1083, 1084, 1085, 1086, 1087, 1088, 1089, 1090, 1091, 1092, 1093, 1094, 1095, 1096, 1097, 1098, 1099, 1100, 1101, 1102, 1103, 1104, 1105, 1106, 1107, 1108, 1109, 1110, 1111, 1112, 1113, 1114, 1115, 1116, 1117, 1118, 1119, 1120, 1121, 1122, 1123, 1124, 1125, 1126, 1127, 1128, 1129, 1130, 1131, 1132, 1133, 1134, 1135, 1136, 1137, 1138, 1139, 1140, 1141, 1142, 1143, 1144, 1145, 1146, 1147, 1148, 1149, 1150, 1151, 1152, 1153, 1154, 1155, 1156, 1157, 1158, 1159, 1160, 1161, 1162, 1163, 1164, 1165, 1166, 1167, 1168, 1169, 1170, 1171, 1172, 1173, 1174, 1175, 1176, 1177, 1178, 1179, 1180, 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2675, 2676, 2677, 2678, 2679, 2680, 2681, 2682, 2683, 2684, 2685, 2686, 2687, 2688, 2689, 2690, 2691, 2692, 2693, 2694, 2695, 2696, 2697, 2698, 2699, 2700, 2701, 2702, 2703, 2704, 2705, 2706, 2707, 2708, 2709, 2710, 2711, 2712, 2713, 2714, 2715, 2716, 2717, 2718, 2719, 2720, 2721, 2722, 2723, 2724, 2725, 2726, 2727, 2728, 2729, 2730, 2731, 2732, 2733, 2734, 2735, 2736, 2737, 2738, 2739, 2740, 2741, 2742, 2743, 2744, 2745, 2746, 2747, 2748, 2749, 2750, 2751, 2752, 2753, 2754, 2755, 2756, 2757, 2758, 2759, 2760, 2761, 2762, 2763, 2764, 2765, 2766, 2767, 2768, 2769, 2770, 2771, 2772, 2773, 2774, 2775, 2776, 2777, 2778, 2779, 2780, 2781, 2782, 2783, 2784, 2785, 2786, 2787, 2788, 2789, 2790, 2791, 2792, 2793, 2794, 2795, 2796, 2797, 2798, 2799, 2800, 2801, 2802, 2803, 2804, 2805, 2806, 2807, 2808, 2809, 2810, 2811, 2812, 2813, 2814, 2815, 2816, 2817, 2818, 2819, 2820, 2821, 2822, 2823, 2824, 2825, 2826, 2827, 2828, 2829, 2830, 2831, 2832, 2833, 2834, 2835, 2836, 2837, 2838, 2839, 2840, 2841, 2842, 2843, 2844, 2845, 2846, 2847, 2848, 2849, 2850, 28

2) Sulphate of manganese (apart from its specific toxic action in large quantities) had rather an injurious than a favourable action, while the corresponding beneficial effect was due to the SO_4 radical and the manganese soluble salt.

3) The results obtained suggest that the varying effects of soluble manganese may be attributed more to its action as a soluble salt than particularly to the acid radicle than to the specific action of the manganese.

Another series of experiments was then carried out to compare the action of compounds of manganese with similar compounds of sodium (preferably sodium since its effect on vegetation is very slight).

The chemical equivalence of the anions was taken into account, and corresponding weights of the same acid radicle were used in each case, so as to be able to compare the action of the various acid radicles.

The experiments were made in 1912 with maize followed by wheat in 1913 and in 1915 with maize in earthenware pots. The quantities per kilo of soil were: manganese 5 to 50 mg.; iron 10 mg.; sulphate to 49.05 mg.; sulphate radicle 8.72 to 104.39 mg.; chloride 12.64.85 mg.; carbonate radicle 27.45 to 137.25 mg.

The quantities of manganese calculated per acre are relatively small. The limits of toxicity, however, were never reached, since in no case the yield was higher than that of the control without salts.

The conclusion to be drawn from these results is that the action of compounds of manganese in small or large doses have a favourable effect, but cannot be regarded as a specific action of the manganese since it is greater than when the corresponding sodium or calcium compounds are used. In some cases the sodium compounds have even shown a more marked effect than the corresponding manganese salts.

The results confirm, therefore, the theory that the varying effects of manganese salts can sometimes be attributed to their action as a soluble salt, especially if they are readily soluble) and to the acid radicle rather than to the particular action of the manganese.

275 - **New Observations on the Concretions in the Pulp of Pears.** - KREYER and BATHYACINE GABRIEL, in *Journal de la Société Nationale d'Horticulture*, Series 4, Vol. XVI, pp. 188-189, Paris, December 1905.

From research made chiefly on the Passe-Crassane variety, the writers conclude that the much thickened cells occurring in the pulp of all pears, even the softest, are not stony concretions (Grew), but the result of a disease of the utricular tissues (Meyer). It is a disease of the cells which have become lignified instead of their walls remaining soft. The chemical analysis of these agglomerations of so-called stony cells confirms the microscopic examination. In actuality these stony bodies are much poorer in ash than the thin-walled cells comprising the greater part of the pulp. These sclerotic cells have, furthermore, the effect of becoming sacchariferous under the influence of dilute hydrochloric acid.

The writers think that they present a certain analogy with the albumen of the kernel of *Phytolophus macrocarpa*, which is known

the name of "corozo", or vegetable ivory. This question is the subject of further research.

Ash Composition of Upland Rice at Various Stages of Growth. GILL, P. L. and J. O. (Porto Rico Agricultural Experiment Station, in *Tropical Research*, Vol. V, No. 6, pp. 397-404. Washington, D. C. November 22, 1915.

In the course of work on the effect of the lime-induced chlorosis in the upland rice of the plant it was necessary to know how the non content varied with its age.

Plants examined were grown in Porto Rican red-clay soil well supplied with phosphate of ammonia, acid phosphate and nitrate of potash.

Conclusions from these results are:

1. The percentage of potash, phosphoric acid, and sulphur in the ash of the plant above ground decreased with the age of the plant, while the percentage of lime increased and the nitrogen in the dry matter decreased with age.

2. The mineral portion of the mature plant at 123 days with ripe grain is less than that of a plant 103 days old with the panicles just out, containing a larger amount of lime, magnesium, and phosphoric acid, slightly less sulphur, chlorine, nitrogen, and silica, much less soda and considerably more potash.

While the iron content of the ash of the whole plant varied but slightly with the age of the plant, the percentage of iron in the ash of the roots and leaves decreased markedly with its age. The withered parts of the plant thus contain a much greater percentage of iron in the ash than the young or live parts of the plants, indicating that iron, like silica, is exported or leached out from the dead tissue to the same extent as the mineral elements.

Prior to flowering the percentages of dry matter in the green and in the ash in the dry matter seemed to be influenced by the effect of the weather on the growth of the plant. Thus, with dry weather prevailing the percentage of dry matter in the green plant was high and the percentage of ash low.

A Method of Propheying the Life Duration of Seeds. CROCKER, W. and GROVER, J. (Department of Botany, University of Chicago in *Proceedings of the National Academy of Sciences*, Vol. I, No. 3, pp. 152-153. Baltimore, March 1918.

The loss of viability of stored seeds has been attributed to exhaustion of food and degeneration of digestive and oxidising enzymes. Food and enzymes, however, are present in full force for some time after viability is lost. The writers suggest that, since the viability of seeds with rise of temperature and moisture content of the seed, it is due to coagulation of the proteins of the plasma of the embryo.

BRUGLIA and MAKINX have shown that the coagulation temperature of proteins is not a fixed point but a function of duration of heating, percent of water present and the reaction of the protein. BRUGLIA established a coagulation formula for the coagulation of protein: $T = a + b \log Z$, T = coagulation temperature, Z = time in minutes and a and b are constants. The writers have made germinating tests at different temperatures

showing that this formula is applicable as a temperature-life formula for seeds. The seeds of Turkish Red wheat were used.

Several factors limit the application of this formula, viz:

1) Increase of acidity of the seed hastens coagulation of proteins, as occurs in seeds of *Rosaceae*.

2) A redispersal of cell proteins takes place coincidently with coagulation in active plant cells. At higher temperature coagulation is rapid and redispersal less prominent. Low water content also hinders redispersal of proteins so that this formula may only apply to seeds of low water content or only under conditions of fairly high temperature.

This theory shows possibilities of throwing light on the problem of viability in seeds and of leading to a quantitative statement of the influence of various storage conditions (especially moisture and temperature) upon the longevity of seeds.

276 - The Effect of Green Manures on the Germination of Various Seeds.

R. B. (Society of American Bacteriologists, V. Industrial Bacteriology, No. 8, Vol. XLII, No. 1976, p. 317, Lancaster, Pa., 1915).

When green manures are turned under and the soil planted in, a decrease in germination may result. This problem was of sufficient importance to warrant a series of field and laboratory experiments in an endeavor to find some explanation for this phenomenon. The data that might be offered to account for the harmful influence of manure on seed germination are:

1) that the green manure not only causes a marked increase in number of bacteria but also a change in the flora;

2) that the great increase in number of bacteria results in a possible accumulation of some substance or substances, toxic to germination;

3) that the rapid multiplication of microorganisms greatly increases their metabolism.

In order to gain some idea of the practical importance of the first series of field tests was conducted. The results of this work show that green clover or oat tissue is turned under and the land planted in it, there is a distinct decrease in the rate of germination with cotton and hemp seed. The cereals, corn and oats fail to show any harm from green manures. After twenty-five days the injurious factor seems to have disappeared entirely. Under greenhouse conditions it has been found that small amounts (0.25 per cent.) of green manures are injurious to germination of cotton seed. Larger amounts are more effective. Addition of calcium carbonate to the green manure fails to prevent their action. The degree of retardation seems to vary somewhat with the type; in heavy soils green manures have their most marked effect. A more or less increase in moisture causes a decrease in rate of germination.

When peptone and casein are added in the same nitrogenous green manure, no decrease in germination is noted. Soluble carbonates in amounts of 1 to 2 per cent. retarded the rate of germination but did not cause the seed to decay as in the case of green manures.

of the soil, the concentrations of carbon dioxide and ammonia in green manure soils. Periodic analyses failed to show the presence of these in quantities sufficient to account for the injury to seed germination.

The Exchange of Ions between the Roots of *Lupinus albus* and Culture Solutions Containing one Nutrient Salt.—TRICE, R. H. and BARTLETT, H. H. (Bureau of Plant Industry, Washington, D. C.) in *American Journal of Botany*, Vol. II, No. 6, pp. 156-178, 1925, 16 figs., 16 June 1925.

These authors work on the antagonism of electrolytes with regard to root growth. It has been shown that absorption is greatest in solutions containing calcium and magnesium nitrates in equimolecular proportions, but that root growth is found to be equally good in a solution which did not contain calcium. One molecule of the calcium salt to nine of magnesium, i.e. 1:00, was found to give an even lower ratio of calcium to magnesium, i.e. 1:00, was found to completely overcome the deleterious effect exerted by magnesium. As regards absorption and growth appear to be more or less independent phenomena. These investigations have been continued with other salts, CaSO_4 , CaSO_4 , MgNO_3 , MgSO_4 , KNO_3 , K_2SO_4 , KH_2PO_4 , KCl and studied their effect on root growth in *Lupinus albus* L.

The range of concentrations used was comparable to the range from 0.0001 to 0.001 molar to the less concentrated soil solutions. In the case of single constituents the range of concentration in the culture solution was greater than the range of the same single constituent among average soil solutions. The reaction of the plant toward electrolyte was studied, at similar concentrations to those occurring under natural conditions.

It is found that the roots of *Lupinus albus* grown in darkness in distilled water give up their salts to the water at a varying rate until the death of the plant occurs through exhaustion of the reserves. Potassium dihydrogen phosphate (KH_2PO_4) and potassium chloride solutions act even in distilled water at the concentrations studied. Solutions of potassium sulphate and potassium nitrate show slight absorption by the root but they differ little from the phosphate and chloride. Solutions of potassium nitrate and potassium sulphate act essentially like potassium nitrate and sulphate.

Solutions of magnesium nitrate and magnesium sulphate support a distinct absorption phase resulting in a net gain of salts to the plant. The more dilute solutions show a net loss of salts and the higher concentrations show a toxic action.

Calcium nitrate and calcium sulphate in all concentrations studied are absorbed by the roots and apparently enable the plants to retain the salts already present in the tissues.

A Three Salt Nutrient Solution for Plants.—SABAY, J. W. in *American Journal of Botany*, Vol. II, No. 4, pp. 157-160, Lancaster, Pa., April 1925.

The author discusses the relative methods of Knop's and Tettingh's nutrient solutions. Since these are four-salt mixtures the writer proposes a three-salt solution containing three salts (monopotassium phosphate, cal-

cium nitrate and magnesium sulphate) which do not readily dissolve. The mixture was tested in solutions of constant molecular concentration (1.75 atmospheres), but with varying proportions of the various nutrients. The plants used were wheat and buckwheat and the results compared with those obtained with Knop's and Tottingham's solutions as follows:

Experimenter & Plant	Four-Salt Solution				Three-Salt Solution
	Knop's		Tottingham's (wheat)		Shrive
	1.00 Atm.	0.75 Atm.	2.5 Atm.	1.75 Atm.	For wheat
Tottingham (wheat)	1.00	—	1.11	—	—
Shrive (wheat)	1.08	—	1.12	—	—
Shrive (wheat)	—	1.00	—	1.16	1.27
Shrive (buckwheat)	—	1.00	—	1.21	—

Thus the three-salt mixture in proper proportions is not only as suitable for plant growth but superior to either Tottingham's or Knop's four-salt solutions.

The best solution for wheat was as follows: KH_2PO_4 ; .0052 m.; $\text{Ca}(\text{NO}_3)_2$; .0052 m.; MgSO_4 ; .0150 m. in volume-molecular concentrations; for buckwheat KH_2PO_4 ; .0144 m.; $\text{Ca}(\text{NO}_3)_2$; .0052 m.; MgSO_4 ; .0200 m.

281. **The Secretion by the Roots of Substances Toxic to the Plant.** — MARIEN, in *Revue Générale de Biologie* (Paris), Vol. 27, No. 122, pp. 252-260, Paris, 1913.

With the object of determining whether the roots of higher plants capable of secreting substances poisonous to themselves the writer in a series of cultures of peas, the roots of which were allowed to develop in distilled water, so as to eliminate the factor of the decrease of these substances present in the solution. In addition, the cultures were kept aseptic, in order to exclude the intervention of micro-organisms. They were sterilised by being placed for some moments in contact with alcohol and subsequently for 2 minutes in a 1% solution of bichloride of mercury. The results obtained were evident from the 2nd crop, the difference between the roots of the peas and those of the controls distinctly noticeable. The water in which the root system of a pea-seedling has grown manifests distinct toxicity to a second seedling and this occurs in the absence of all micro-organisms. After further experiments to dispose of any doubts that could possibly remain as to the method of sterilisation and of the different conditions of the experiment, finally, the writer concludes that the roots of peas secrete substances having a toxic effect even upon the organ which produces them, and that

any bacterial intervention. As other experiments have shown, the carbonic acid produced by the roots only causes a slight decrease in yield. In comparison, the decrease in the yield must be attributed to the changes, the action of which is not diminished by raising the temperature of the solution to 120° C. for a period of 20 minutes. The water in which the root system of the peas developed, contained some nitrogenous substances in solution. Cultures of maize in which peas had been grown and *vice versa* failed to reveal any correlation on the part of the secreted substances.

Respiration Experiments with Sweet Potatoes.— HASTHORN HENRICH and ROBERT A. (Plant Physiologists, Bureau of Plant Industry) in *Journal of Agricultural Research*, Vol. 12, pp. 509-517, Washington, D. C., December 20, 1918.

1. Experiments were performed to determine the correlation, if any, between the seasonal changes in the sugar content of sweet potatoes and their respiratory activity, and incidentally to determine whether the monosaccharids or the disaccharids of the sweet potato furnish the chief material for respiration.
2. Sweet potatoes were placed in a water jacketed incubator at a constant 35° C., and the carbon dioxide of respiration collected by passing a carbon dioxide-free current of air through the apparatus into a soda potash. At the end of every 24 hours the amount of carbon dioxide was determined by precipitation with barium chloride.
3. Amounts of moisture and sugars were determined at the beginning and at the end of the experiment.
4. Results showed that there is no general correlation between the sugar content of the sweet potato and the respiratory activity. The respiratory activity diminished with the content of reducing sugars, indicating a degree of correlation between these two factors, but, in different experiments, seasonal changes and environmental conditions effect changes in the composition which tend to obscure any such correlation.
5. Experiments with wounded roots indicate that the sugar content is not a determining factor in the respiration of the sweet potato. The reducing sugars are the immediate source of respiratory material and the cane sugar when fermented does not appear to be readily utilized in the process of respiration, while starch and other carbohydrates are present in abundance.

On the Relation of Root Growth and Development to the Temperature and Aeration of the Soil.— CANNON W. A. in *American Journal of Botany*, Vol. 11, No. 1, pp. 213-233, 1924, 1925, Part I, May 1925.

1. The author discusses the soil thermograph records made at the Tucson Agricultural Laboratory in relation to the growth of species having unlike root systems, *Prosopis juliflora*, *Fouquieria splendens* and *Opuntia versicolor*.
2. At a depth of 15 cms. the mean maxima in 1910 ranged from 8.1° C. in January to 31.5° C. in July and the mean minima ranged from 1.0° C. to 20.1° C. in the same months. At a depth of 20 cms. the mean maxima ranged from 7.1° C. in January to 32° C. in July, whilst the mean minima were 0.5° to 22.2° C.

At a depth of 2.6 metres the mean maxima ranged between 19° and 20° C., in January and 27-29° C., in July.

The growth rates of the roots of the three species were determined in box cultures.

At all temperatures the roots of *Prosopis* grew more rapidly than those of *Fouquieria* and *Opuntia*, this difference being especially marked at temperatures below 2° C. and between 3° and 4° C. At a temperature of 20° C. growth ceases in the case of the two latter species but continues in that of the former. Thus the low temperatures of the deeper layers do not inhibit the growth of *Prosopis* and as the roots are not dependent in the aeration relation, deep penetration results.

It appears that deeply penetrating root systems are only limited by the depth of soil, whereas shallow rooting systems are more subject to environmental limiting factors. The roots of *Opuntia* and *Fouquieria* grow under favourable conditions grow nearly as long as those of *Prosopis*. The sensitiveness of roots to environmental conditions would appear to be an important factor in the distribution species, the species having narrow roots being most restricted in their distribution.

284 - **A Study of the Relation of Transpiration to the Size and Number of Stomata.** - MUESSIGER, W. L. C. In *American Journal of Botany*, Vol. 11, No. 6, pp. 717-722. Publ. November 1915.

Experiments were performed with *Helianthus annuus*, *Urtica dioica*, *Portulaca oleraceae*, *Polygonum orientale*, *Phaseolus vulgaris*, *Primula sinensis*, *Rosa rugosa*, *Linum catharticum*, *Trifolium sativum*, and *Zea mays* to determine the amount of transpiration in relation to the size and number of stomata per unit of leaf surface.

No definite relation was found between the amount of transpiration and either the number of stomata per unit of leaf surface or the length of the stomatal pore in the different species investigated.

It would therefore seem that the amount of transpiration is regulated entirely by stomatal regulation, and that the variations in the amount of water lost in different species can only be explained by a complex of several factors.

285 - **Translocation of Mineral Constituents of Seeds and Tubers of Certain Plants during Growth.** - BOEKER, G. D. (Chemist, Kentucky, Agricultural Experiment Station). In *Journal of Agricultural Research*, Vol. V, No. 11, pp. 449-458. Washington, December 15, 1915.

The translocation of mineral matter (phosphorus, calcium, potassium, magnesium and silicon) from seeds to the parts of the seedlings was investigated in the case of *Phaseolus vulgaris*, *Zea mays* and the potato (*Solanum tuberosum*).

The seeds were germinated under sterile conditions. Some seedlings with perfect cotyledons were selected and grown to maturity in distilled water. The plants were then divided into roots, lower stems (2 inches in height), exhausted cotyledons, upper stems (2 inches in height) and leaves. The liquid remaining from the cultures was evaporated to dryness and weighed.

Each of 600 beans was germinated similarly but only allowed to grow the first radicle. The integument and cotyledons were carefully separated separately.

The amount of ash in the two series of beans was well within experimental error. The percentage distribution of the various constituents of the beans was as follows :

Constituent	Phosphorus as P_2O_5	Calcium as CaO	Magnesium as MgO	Potassium as K_2O	Silica as SiO_2
Integuments	47.20	54.55	45.07	48.9	40.72
Cotyledons	7.08	13.72	6.14	8.72	19.47
Integuments + Cotyledons	54.28	68.27	51.21	57.62	60.19
Integuments	13.00	18.51	19.24	12.51	9.48
Cotyledons	24.34	19.15	27.43	27.83	23.69

It is seen that approximately 50 per cent. of the total mineral matter of the cotyledons remains unused, the other half being translocated to the several parts of the plant, most of it accumulating in the leaves and stems. A notable amount of the calcium and silica accumulate in the roots.

Similar experiments were carried out with mize, using aluminium cups and soil-filled tubes for the seedlings. The percentage distribution of the mineral constituents was as follows :

Constituent	Phosphorus as P_2O_5	Calcium as CaO	Magnesium as MgO	Potash as K_2O	Silica as SiO_2	Iron as Fe_2O_3	Alumina as Al_2O_3
Integuments	26.38	30.02	28.71	35.74	16.84	2.54	3.41
Cotyledons	43.24	43.86	47.04	20.00	58.00	49.47	4.88
Integuments + Cotyledons	69.62	73.88	75.75	55.74	74.84	51.01	8.29
Integuments	17.44	13.21	16.82	21.17	6.41	22.92	3.98
Cotyledons	12.94	12.94	7.43	23.09	15.09	25.55	88.09

In the exception of potash, 50 per cent. of the mineral constituents are translocated from the cotyledons to the several parts of the seedling. In the case of potash, nearly 80 per cent was removed from the cotyledons, of this being transferred to the leaves. The taking up of potassium from the cups and its storage in the roots is also of interest.

In the experiment with the potato, well cleaned tubers were allowed to sprout in a dark closet. When the tubers softened the sprouts were removed and the tubers dried and analysed.

The distribution of the mineral matter was as follows:

Part	Mineral matter in 100 parts of dry matter			
	Phosphorus P_2O_5	Calcium CaO	Magnesia MgO	Potash K_2O
New sprouts	17.77	13.12	15.84	12.68
Tuber (exhausted)	67.13	42.92	65.68	64.4

Thus, a considerable amount of the mineral matter remains in the tuber.

The most striking fact brought out by these results is the rather considerable amounts of mineral matter in the seeds and tubers, probably due to the necessity for definite amounts of the various constituents to promote the katabolic changes occurring in the seed and tuber during sprouting.

286. **Experiments in the Improvement of Wheat at Svalöf, Sweden.**—Nils-Edvard *in Svenska Lantbrukets Tidskrift*, Year XXV, Part I, pp. 42, 968-104, Stockholm.

The writer reviews the work of the past six years on the improvement of wheat in Sweden and gives the results of recent experiments on types selected at Svalöf, viz.: "Pansar" and "Fylgia" which are adapted to the particular climatic conditions of Scania and yield more than any other variety under cultivation.

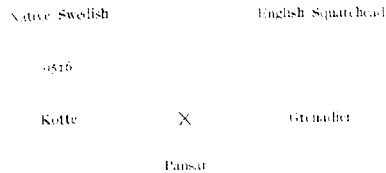
The improvement work began in 1908 with the introduction of "Squarehead II" and "Sol" which soon replaced the older varieties "Squarehead I" and "Grenadier" owing to their higher yielding capacity which compared with that of Native Swedish is as follows:

Sol	125	Grenadier	130
Extra Squarehead II	126	Extra Squarehead I	126
Grenadier III	128	Native Swedish	125

The improvement of wheat in Sweden is a question of how far the characters "yield" and "resistance to cold" be combined in the same strain. Ordinary English "Squarehead" yields in England much more than "Sol" and "Extra-squarehead II", but owing to its less resistance to cold it yields less when planted in Sweden than the other varieties.

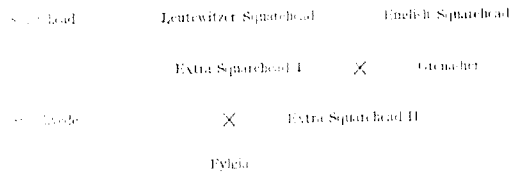
In 1907 a cross was made between "Smaahvede" and "Extra-Squarehead II" with the object of obtaining a more efficient variety combined

and resistance to cold. A new type known as "Fylgia" was obtained. In 1903 the variety "Pansar" was obtained as a hybrid of "Kotte" and "Grenadier" and this has since been improved by these parents in their turn were obtained from native Swedish English Squarehead, so that the origin of "Pansar" may be thus shown:



The experiments carried out, including field experiments, have shown that "Pansar" to be superior to the parents in combining the rust and resistance of "Kotte" with the high productivity, early maturity and strong stem characteristic of the "Grenadier" type. In appearance it has more Grenadier than Kotte. The stems are vigorous, elastic and longer than those of Grenadier and it is most distinct in its large and compact ears.

The origin of the "Fylgia" type is as follows:



"Extra Squarehead II" is more resistant to cold and stiffer in the straw than "Squarehead" which is a higher yielder and more rust resistant.

In combining all the characters of its parents "Fylgia" gives an average yield of grain but its straw is less resistant than that of "Extra Squarehead II" and is not suitable to localities where this character is necessary.

A similar series of observations was undertaken at Svalöf from 1908 to 1912 to test the superiority of the new types "Fylgia" and "Pansar" to the older types.

The observations are summarised in the following table:

Type	Grain, lbs. per acre							Average yield
	1905	1909	1910	1911	1912	1913	1914	
Pansar	457	3,185	4,544	4,877	4,416	5,455	4,176	4,403
Fylgia	—	—	—	—	4,237	5,355	4,977	4,523
Tystofte-Smådhyvel	4,006	2,796	4,962	4,737	3,581	5,201	4,164	4,148
Sol	1,176	1,431	4,425	4,740	3,717	4,764	4,047	4,141
Extra Squarehead II	1,676	2,668	4,387	4,719	3,777	4,497	3,865	4,041
Weibull-Ettmål	—	—	—	4,270	4,069	4,785	3,762	4,231

The superiority of "Pansar" and "Fylgia" is also seen in the experiments carried out in other parts of Sweden.

	Multitudes				100
	1911 (100)	1912 (100)	1913 (100)	1914 (100)	
Fylgia	—	—	93	106	—
Pansar	100	100	100	100	100
Sol	75	100	94	91	75
Extra Squarehead II	85	96	94	83	75

Contrary to observations at Svalöf, Fylgia gave better results than Pansar owing to the variation in the soil in the various places. In warm soil Fylgia gives better results than any other variety.

The following table shows the improvement made in the wheat at Svalöf in a comparatively short time, the values being given as per cent of the yield of native Swedish wheat :

Pansar (Kolte \times Grenadier)	140	Grenadier	100
Fylgia (Smådhyvel \times Extra Squarehead II)	148	Tystofte-Smådhyvel	100
Tystofte-Smådhyvel	141	Gröwärd I	100
Sol	141	Vilhelmina	100
Extra Squarehead II (Extra Squarehead I \times Grenadier)	129	Extra Squarehead I	100
Kolte	128	Native Swedish	100
Grenadier III	125	English Squarehead	100

Only one character, for instance productivity, can be influenced by a greater number of factors than one and consequently it is possible to get a hybrid of greater productivity from two species of equal productivity.

This is represented in the following manner, the factors for productivity being represented by capital letters and their absence by small

Yields of "Stüde" and "Petkus" compared with those of other strains

Strains	Yield of grain lbs. per acre						Average yield of Petkus during the same years	Average yield referred to yield of Petkus	Percentage of yield compared with Petkus = 100	Percentage of grain
	1907	1908	1909	1910	1911	1912	1913	1914		
Stüde	3,515	4,315	4,682	4,300	4,111	3,530	3,501	3,048	3,011	108.3
Petkus	3,509	4,413	4,766	3,581	3,687	3,004	3,212	2,724	3,012	100.0
Brückner	3,015	4,467	4,145	3,620	3,751	2,892	2,758	2,000	3,497	96.8
Schäntzler	2,682	3,747	3,888	3,010	3,307	2,832	2,728	2,587	3,221	89.2
Milsumar	—	—	—	—	3,100	2,721	2,809	2,400	2,810	89.0
Wase	—	—	—	2,914	2,609	2,371	2,914	2,394	2,665	82.2
Prof. Heinrich	2,416	3,022	4,050	3,026	3,071	2,371	2,660	2,600	3,612	82.0
Prof. Schöner	—	—	411	2,602	2,914	2,600	2,600	2,428	3,420	82.0

possesses a slightly higher percentage of grain, 35.9 against 35.6. This variety, however, excels in regard to the grain characters, the weight of the grain being 58.74 lbs and that of Petkuser 57.38 lbs. With regard to weight per 1000 grains the two varieties are equal (20.3 and 20.4 gms.) and are equal with regard to resistance of stem and hardness.

Mutations of Wild Species of Tuberiferous *Solanum*. ARNOT, L. (in French), *Annales de l'Académie d'Agriculture de France*, Vol. I, No. 13, pp. 61-69, Paris, 1913.

The writer has been able to observe in various species of *Solanum* the occurrence of mutations affecting the different organs of the plant, and he concludes that these species in no wise possess the immutability that has been ascribed to their specific characters.

For example, he found in his Anse cultures, a plant of *Solanum commersoni* which was completely transformed and had entirely the appearance of a potato approaching the "Richter's Emperor" type. Leaves greenish or a greyish green, somewhat fluted, with 3 or 4 pairs of lateral lobes, with numerous and wide folioles; leaflets acuminate. When cut this plant had 3 good tubers literally glued to the stem and in successive nodes at intervals of about 2 cm. These tubers were apparently ripe. Their shape is regular and rounded, the surface slightly protuberances, the eyes are few and not deep. The skin is yellow and somewhat wrinkled in places, showed on removal only traces of lenticels, which disappeared with time. The plant did not differ in anything from the complete transformation of the leaves and the different organs, the mutation seems total and definitive. The mature tubers (July 31) shows that the variety is an early one.

On October 9, 1914, the writer planted in a pot a very small tuber of *Solanum maglia* from the crop of 1913. His attention had been attracted by a very fine shoot which was absolutely free from all pigmentation, the tubers of this species are always violet. Further, according to tradition, the colour seems to be a fixed character of the tubers of wild species of *Solanum*. The first flowers opened at the end of March and, like the parent plant, presented the general characters of *S. maglia*. On taking the plant on June 16, the writer found a single tuber, which was quite small. This tuber was of the size of a small walnut and round, it had few, deep-set lenticels, its colour was white slightly tinged with yellow, it was raised from the ground, and it showed no subsequent sign of pigmentation; the plant was therefore certainly a white *Solanum*.

The tubers of *S. Bitterii*, which are yellow on removal from the soil, become dark violet after some days, if they are exposed to the air. The tubers raised from seed sown at Marseilles in 1913, produced tubers that turned violet after a fairly long time, and others that remained yellow till the end of April 1915; while one plant bore violet tubers.

4. *S. commersoni*, mutation, L. Planchon, is very similar in many of

its general characters to the "Imperator" type. Its growth was less vigorous, the colour of its leaves is distinctly different, more erect, it ripens earlier and is less productive. The tubers which were received and planted were average in size, round or more or less flattened, very regular and the eyes were superficial or of no account.

The shoots were violet, the skin yellow, generally smooth, except in the case of some tubers.

The tubers harvested by the writer at Villeurbanne (Lyon) corresponded to this description except that their skin was much more wrinkled; at Anse their shape varied indefinitely, some being round, others round or even long, and more or less flattened; one large tuber was of the "rose" type. Finally, the skin, which was rather wrinkled, had a dark yellow hue.

5) The tubers of wild tuberiferous species of *Solanum* are characterised by the lenticels of their skin which vary in their number and degree of development. The writer observed, in 200 specimens, similar lenticels in cultivated potatoes.

In a plantation of Bolivian varieties, his attention was attracted to a stem bearing aerial tubers which were remarkable in more than one respect. The plant belonged to a variety called by the writer "allongée". The stem when uprooted was found to bear at its base underground tubers which were apparently ripe and had the periderm being covered, (like the aerial tubers), with prominent lenticels similar to those seen on wild potatoes.

Other tubers kept by the writer and coming from plants from unidentified cultivated seed tubers are also covered with prominent lenticels resembling those observed on the tubers of the wild *S. tuberosum*.

6) In 1914, a sowing of a red Bolivian variety which the corolla showed a characteristic alteration in the form of the corolla, calyx, stamens and pistil had the characters of an *S. tuberosum*, the corolla, which was less deeply lobed than that of *S. commersonii*, but it was nevertheless very star-shaped, the lobes being long and pointed. In 1915, the same plant, when reproduced from its first year's bore similar flowers, but the corolla was smaller.

From all these observations, the writer concludes, contrary to the opinion, that the wild species of *Solanum* possess no immutable characters, whether of the aerial or subterranean organs.

280 - Selection Experiments with Timothy Grass (*Phleum pratense* L.) from Sweden. - WITTE, HERNERD in *Swedish Usadobanans Tidsskrift*, No. 1, 1914, pp. 1-11, fig. 1-5; Part 4, pp. 143-182, fig. 6-24; Part 5, pp. 160-221, 247.

The writer discusses the origin and geographic distribution of the grass and describes the methods in use at Svalöf for its improvement.

The original material used for the strains was selected from the grasses or collected in the fields at Svalöf. Each strain was then propagated vegetatively in isolated plots. These pure lines thus obtained were selected from the point of view of yield of forage. Those types which showed

over a number of seasons and which show stability of characters when produced on a large scale and introduced into commerce.

Character on polymorphism in *Panicum* and the inheritance of anatomical and physiological characters merits special attention.

Length of stem.—This varies between wide limits, from 12 or 16 to 20 in. In some cases this character is definitely inherited, in others it is very dependent upon particular environmental conditions.

Length of internodes.—This varies from 5 to 8. In some cases the lower upper internode is equal to half or the total length of the stem, usually one quarter. The length of the lower internodes also shows wide variations. In selecting seed-bearing plants it is desirable to choose with long lower internodes and relatively short upper ones. These characters seem to be hereditary.

It is easy plants are obtained with the mass of the foliage rather high and thus facilitating the harvest and reducing the loss of forage through which notoriously injures the lower leaves most.

Curvature of stem.—Varies from one form to another and is naturally short stemmed plants without, however, being correlated with

Position of stem.—In some types the stem has a vertical position, in others more or less inclined almost to the point of touching the ground. This is also hereditary.

Leaves.—Either open or dense.

Size of leaves.—The size of the upper leaves varies from 0.18 to 0.2 in. breadth and 0.67 to 0.7 in. in length. The differences are still marked in the ratio between breadth and length: the extreme ratio being 1:4.5 for leaves low down on the stem and 1:20.2 for the upper ones. From the practical point of view, a large leaf surface is preferable and advisable to select plants with long and moderately wide leaves.

Shape of leaves.—This may vary as much before the development of young stems as at the flowering period. In some cases the leaves are straight and curved towards the ground whilst in others they are straight and

erect. There are considerable variations in length, thickness, and compactness. The length varies from 0.70 to 6 inches and the thickness from 0.12 or 0.15 in. to 0.31 or 0.39 inches. There is no correlation between the length and thickness of the ear, nor between length of ear and length of stem. The shape of the ear is generally cylindrical but sometimes more or less pointed towards the extremity. In typical varieties the spikelets grow into the main axis, but in certain cases the extremity is free from the axis. This character is also hereditary. From a practical point of view length, and, up to a certain point, compact ear only are of importance in selection, the greatest quantity of seed being produced by long compact ears.

Glumes.—There are numerous variations especially in the shape and position of the outer and inner glumes. In some the glumes are slightly awned.

The colour of the anthers varies from pale yellow to violet. The weight of 1000 seeds varies between 0.21 and 0.88 gms.

Resistance to cold. -- Some interesting observations have been made on this subject by ULANDER at ZULEA for types of *Phleum* of various origin. Thus in the spring of 1909, out of 24 types from Kalmar and 10 from 3 or 13 per cent were resistant while out of 66 from Nowborg 25 per cent stood well the rigours of very severe winters.

Germination. -- Both early and late types occur, the characters are hereditary. There appears to be no relation between the time of germination and the time of flowering, nor between the date of sowing and that of the preceding harvest. This is also true of the *straw* in which the difference between the early and late types may be as 3 or 4 weeks.

Resistance to lodging. -- This character varies considerably and is transmitted from one generation to another.

Second growth. -- This character varies both in quantity and in certain forms it is insignificant, in other it results only in the growth of leaf shoots, and in others again it proceeds to the formation of new ears.

The writer gives some information of practical importance as to the behaviour of the glumes and pales at the period of maturing seeds. He recommends the selection of types in which the spikelets detached from its axis, whilst the pales remain strongly adherent to seeds thus preventing damage during the threshing.

Resistance to Rust. -- Varies considerably and is hereditary. Selection and isolation of pure lines leads to improvement.

Resistance to drought. -- The most resistant forms are native dwarf types with reduced leaf system.

Owing to the great variability of the different characters it is possible to produce stable types. The mother plants of pure lines are always heterozygous hybrids for several characters. Therefore the selection of the most uniform types is necessary, grouping them according to the object in view.

Thus for two year leys the following characters are desirable:

- 1) Stems straight, long and sufficiently rigid; the upper internode should be short and the lower internode relatively long.
 - 2) Tillering abundant and vigorous.
 - 3) Large mass of leaves remaining green and fresh to the time of harvest.
 - 4) Abundant aftermath.
 - 5) Resistance to low temperatures.
 - 6) Rust resistance.
 - 7) Maximum growth and yield in the second year.
- Types for pastures should possess the following qualities:
- 1) Vigorous tillering.
 - 2) Growth rapid and abundant after pasturage.
 - 3) Resistance to cold.

Yields of various types.

	Average total yield		Average yield of first cut	
	Fresh hay lbs. per acre	As percentages of Swedish type	Fresh hay lbs. per acre	As percentages of Swedish type
Phleum pratense	20 135	99.0	19 082	99.6
Phleum pratense	20 349	100.0	18 930	98.8
Phleum pratense	20 161	100.0	19 153	100.0
Phleum pratense	22 350	101.6	20 322	99.1
Phleum pratense	22 124	100.0	20 920	100.0

1911

3. Longest possible duration of life.
4. Hay and seed as well as hay should possess the following characters:
 - a. Stems long, rigid and compact.
 - b. Seeds well developed and separating easily from the glumes.
 - c. Tendency to autogamy.

Analyses of observations was also made on the relation between the yield and the meteorological factors, rainfall and temperature in particular, with a view of facilitating the comparison of the factors under investigation. Two periods were considered: 1) from April to the first cut, and 2) from the first cut to the month of August.

The growth was more abundant as the average temperatures were higher and the rains more abundant and well distributed. Thus in 1912 from the beginning of April until July 8-11, the time of the first cut, the temperature was below normal and the rains frequent, alternating with short periods of drought. From July 11 to 28 drought prevailed, but from July 28 to August 11 abundant rain fell (106 mm. in 23 days) and the temperature was low. In 1912 the yield of hay exceeded those of the other years: 1910, 19 550 lbs per acre in 1911, 12 865 lbs per acre in 1910, and 10 161 lbs per acre in 1909.

In 1914, 112.8 mm. of rain fell during the first period, of which 65 mm. in the first half of April; 26.2 mm. in May, with 12 rainy days with a maximum of 4.5 mm. in one day; 14.8 mm. in June with 8 rainy days and a maximum of 4 mm. During the second half of summer there were 120 mm. of little rain: July 24-29 with 46.1 mm. and August 3-11 with 73.9 mm. The temperature was almost always above normal. In 1914 the yield of hay was very low; the 1913 leys yielded at the first cut 7805 lbs per acre with an aftermath of 937 lbs; and the 1912 leys 5085 lbs per acre.

The yields of the various selected types at Svalöf are also interesting. In the field experiments "Primus Timothy" (already on the market) gave an average yield 16 per cent more than ordinary Swedish *Phleum*,

but was exceeded by a new type, No. 217, which is very productive and will soon be placed on the market.

Amongst foreign varieties, the Russian, Saxony and American types give much in the first cut as ordinary Swedish *Phleum* and give a good second crop. The Finland type gives a first crop equal to the Swedish, but its aftermath is inferior.

The following table gives a summary of the yield per acre of the first cut according to all experiments made at Svalöf.

1st year	A Grass	2,522 lbs. (maximum)	19,548 lbs. (minimum)
	C Hay	2,597 lbs. ()	8,443 lbs. ()
2nd year	A Grass	2,515 lbs. ()	12,464 lbs. ()
	C Hay	3,771 lbs. ()	6,887 lbs. ()
3rd year	A Grass	2,736 lbs. ()	11,628 lbs. ()
	C Hay	3,514 lbs. ()	5,250 lbs. ()

6. 299. Comparative Researches on the Dimensions of the Seeds of Clover and Dodder (*Cuscuta*) (1). — HENRICH M. in *Die Landwirtschaftlichen Versuchs*, 8, 2.

No. 4, pp. 268-268, Berlin, December 27, 1915.

The writer set himself the task of determining whether the well-known differences in the swelling property of seeds could be used as a means of distinguishing the seeds of dodder from those of clover. For this purpose he measured out a large number of seeds, 50 for each species, in glass lots of 10 at a time, placing the lots side by side. The species studied

- | | |
|------------------------------|--|
| 1) <i>Trifolium pratense</i> | 2) <i>Cuscuta tribulifl.</i> Babington |
| 2) <i>Trifolium repens</i> | 3) <i>Cuscuta racemosa</i> Martii |
| 3) <i>Trifolium hybridum</i> | 4) <i>—</i> <i>—</i> Seringe |

The red clover came from : Mecklenburg ; Bohemia ; Austria ; Holland ; Russia ; North America and Chili.

DIMENSIONS OF AIR-DRIED SEEDS. — Measurements gave the following results :

	Length of seed in mm.	Breadth of seed
<i>Trifolium pratense</i>	1.067 \pm 0.0213	1.428 \pm 0.021
<i>Trifolium repens</i>	1.220 \pm 0.0086	1.004 \pm 0.011
<i>Trifolium hybridum</i>	1.236 \pm 0.0088	1.086 \pm 0.011
<i>Cuscuta tribulifl.</i>	0.640 \pm 0.0338	0.810 \pm 0.011
<i>Cuscuta racemosa</i>	1.286 \pm 0.0571	1.130 \pm 0.011

These figures do not differ greatly from those obtained by other servers. On examination, the figures given for red clover from the various localities are found to differ from one another as regards some details, but these differences are often difficult to determine, on account of the number of intermediate seeds. The largest seed was that of the Meck-

(1) See also B. January 1916, No. 127.

the smallest seed that of the Russian. The seed of *Cuscuta racemosa* was obtained from a sample of Silesian clover and the *Cuscuta racemosa* from one of Chilian clover.

MEASUREMENTS OF SWOLLEN SEEDS.—The seeds were swollen by placing in distilled water at a temperature of 16°C. After germination they were dried and measured, when they gave the following results:

	Length of seed in mm.	Breadth of seed in mm.
<i>Cuscuta trifolii</i> (Russian)	2.570 \pm 0.0083	1.873 \pm 0.0060
<i>Cuscuta trifolii</i> (Silesian)	4.043 \pm 0.0111	1.486 \pm 0.0140
<i>Cuscuta trifolii</i> (Chilian)	4.768 \pm 0.0151	1.609 \pm 0.0146
<i>Cuscuta racemosa</i> (Silesian)	4.093 \pm 0.0118	0.874 \pm 0.0114
<i>Cuscuta racemosa</i> (Chilian)	4.139 \pm 0.0117	1.201 \pm 0.0148

These results show that in *Cuscuta* seed there is less difference between the size of the dry seed and the swollen, than there is in clover seed, the difference is very great.

COMPARISON OF THE DIFFERENCE BETWEEN DRY AND SWOLLEN SEEDS.—The study of the difference in the size of the dry seeds and of the swollen seeds, shows that even when dry, there is a difference between the seeds of red, white and hybrid clovers and those of *Cuscuta trifolii*. The difference in dimension is in all cases increased.

The seeds of *Cuscuta racemosa* things are somewhat different. Both the dry and the swollen seeds of red clover are larger than those of this dodder. The seeds of white clover and of hybrid clover are, on the contrary, smaller than those of *C. racemosa*, while the swollen seed is larger.

PRACTICAL USE OF THE DIFFERENCES IN SIZE AS A MEANS OF DISTINGUISHING THE TWO SPECIES OF SEED.—The observations made on the difference between the size of dodder seeds and that of clover seeds lead the writer to conclude that it would be impossible in all cases to distinguish the seeds in order to distinguish them, but that in certain cases this method might give good results, if carried out as follows: the seed sample to be examined, after having been swollen according to the method already given, is first passed through a No. 60 sieve. The seeds are then placed on filter paper and examined. The seeds of dodder can thus be distinguished from the clover seeds.

CONCLUSIONS.

1. Clover seeds from different localities show, when dry, differences in their dimensions.

2. These differences disappear, to a large extent, when the seeds are swollen.

3. When dry, the seed of *Cuscuta trifolii* is smaller than the seeds of red, white and hybrid clover.

4. When dry, the seed of *Cuscuta succolens* is also smaller than the

seed of red clover, but it is the same size as the seed of white clover.

5) Swelling increases the differences in size in the case of red clover and of *Cuscuta trifolii*: it also produces a difference between the seeds of white and hybrid clovers on the one hand, and of *Cuscuta suaveolens* on the other.

6) By passing the swollen seeds through a sieve, it is possible to separate the clover seeds from the dodder seeds.

291 - Report of the Committee on Home-Grown Wheat 1913-1915.

National Association of British and Irish Millers, pp. 19, Plate I, London, 1915.

This report contains an account of the objects of the Home-Grown Wheat Committee founded in 1901 and a summary of the results of its work in the improvement of English wheats up to the present time.

Since some grades of flour are liable to contain a certain amount of bran powder which darkens the colour of the flour it was thought desirable to obtain a white wheat of good quality so as to diminish the effect of the bran. With this object White Fife was imported in 1890, but on growing it in England it showed a partial degeneration. Subsequent selection showed that the original strain really consisted of two strains, one of which maintained its quality independently of growing conditions, whilst the other was only able to maintain its quality in Canadian conditions.

Burgogne's Fife, a hybrid between a soft English wheat (Chaff) and a hard Canadian wheat (Red Fife) has been the standard during recent years. As regards its baking quality it resembles its parent, being somewhat inferior to the best Red Fife. Analysis of "Fife" strains shows that they are not homogeneous as regards baking qualities. Burgogne's Fife is therefore not considered to be a standard, deciding the question as to whether "hardness" in wheat is due to "softness".

In view of the fact that neither Red nor White Fife wheats are homogeneous as to quality of endosperm and that neither the nitrogen content of the grain is a reliable index of its strength, the importance is attached to the selection of strong parents by breeding trials. Since, however, appearance is likely to remain the same in the markets it is undesirable to produce strong wheats which appear weak or weak wheats which appear strong.

The wheat breeding investigations have been continued, and have been made between certain strains of Fife, both red and white, and the best English varieties, such as Square Head's Master, Broadbent's wheat, also with heavy yielding varieties raised in the course of experiments.

In selecting the hybrids the chewing test is found to be the best for estimating the quality of the grain.

(1) See also *E.*, August 1913, pp. 1164-1166, A. E. HUMPHRIS, Wheat, from the National Association of British and Irish Millers' Point of View.

the types possessing the strength of the best Fife strains and the cover of Square Head's Master are retained.

Investigations are also being carried on with Szeelman wheats obtaining short season varieties.

Experiments.—The committee has not concerned itself with the effect of increased tillering on yield, but only with the question as to whether increased tillering develops the plant by drawing on the reserves of plant food in the grain, thus changing the constitution of the grain and improves its baking qualities. Transplanting experiments were carried out and it was found that the character of the grain was considerably changed by the process. Wheat transplanted yielded 12.70 per cent of gluten while wheat grown under ordinary conditions yielded only 6.02 per cent. Baking, however, no difference was discernible in the bread, and the digestibility was poor.

Experiments.—Magnesia used as a manure made the wheat more pliant but had no effect on the baking quality.

Japanese Rice "Sekyama" in Italy.—NOVATI, N. in *L'Italia Agricola*, Year 52 (1913), Plate, Piacenza, September 13, 1913.

Experiments with this variety of rice were made in 1908 by the Experiment Station for Rice Cultivation at Vercelli and on the present day it is not one of the most widely grown crops it occupies a notable position in some districts, especially in the districts of Milan and Pavia, in Lombellina and also in the province of Mantua. It grows particularly well in rather rich soils under rice for the first time. It has vigorous growth, disease resistant, and a high yielder. It has the advantage of early maturity. As an early crop it is grown particularly in fields where other varieties of equal yielding capacity are late in maturity. In habit of growth it resembles somewhat a variety known as *grasse biondo* (Japanese blond) a variety extensively grown in several years ago.

From the commercial point of view, it is one of the least appreciated crops, but on account of its productivity and high milling yield it is worthy of the greatest consideration.

Relation of Cultivation and of Number of Stalks per Hill to Yield of Maize Crop.

by H. H. HALL, in the University of Minnesota Agricultural Experiment Station, Bulletin 100, 1913, 100 pp., University Farm, St. Paul, June 1913.

RELATION OF CULTIVATION TO YIELD AND CHARACTER OF CROP.—Equal plots of equal size were laid off each year on a uniformly prepared land. The preparation of the land for all plots was exactly the same each year. They were ploughed, disked, harrowed, marked off, and sown and all the plots were planted the same day, and all the plots except plot No. 1 were harrowed after planting according to the usual practice. The further treatment differed only in the number of cultivations.

Minnesota No 13 maize was sown. The experiments were repeated

in 1908, 1909 and 1910. The plan of the experiments and results are given in Tables I and II.

TABLE I.—*Treatment of Plots after Planting.*

Plot	Harrowed	Cultivated
1	Not at all	1. All weeds allowed to grow
2	Once after sowing	2. Once each way
3	—	3. Twice one way and once the other
4	—	4. Twice each way
5	—	5. Three times each way
6	—	6. Weeds kept down with hoe

TABLE II.—*Average Results of Cultivation Experiments 1908-1910.*

Plot Number	1	2	3*	4
No. of cultivations	0	2	3*	4
Per cent barren stalks	25.2	9.7	21.7	5.8
Per cent stand when cut**	97.0	84.7	94.3	93.5
Height of stalk, inches	25.5	31.5	33.0	38.5
Per cent of marketable ears by weight	0	58.0	43.0	53.0
Yield of maize per acre, bushels	0.02	35.60	48.15	50.07
Yield of stover per acre, pounds	2,090	3,210	3,750	3,800
Average yield of maize per acre 1909 and 1910, bushels	3.32	38.93	48.10	50.27
Average yield of stover per acre 1909 and 1910, pounds	2,051	3,711	3,750	4,193

Cost, Profit and Loss.

Value of crop	4,320	21,931	23,112	28,350
Cost of production (exclusive of cultivation and husking)	11,790	11,790	11,790	11,790
Cost of husking	0.31	3,168	3,300	4,131
Cost of cultivation	—	974	1,401	1,918
Total cost of production	12,130	15,927	16,620	17,881
Profit	—	5,960	6,492	10,469
Loss	8,161	—	—	—
Increased profit by cultivation	—	14,091	532	3,927

* A two year average 1909-1910.

** Compared with number left after thinning, namely three per hill.

CEREAL AND PULSE CROPS

The above data show: 1) that to a certain degree, the lack of cultivation is compensated by an increased percentage of barren stalks. 2) Though the "over-cultivated" plot is an exception, the increase in the number of cultivations tends to have a tendency to lower the percentage of stand. The difference, however, is not sufficient to warrant definite conclusions. 3) The percentage of barren stalks and of the ears on the stalk does not appear to be influenced by the cultivation, except that with no cultivation they are considerably lower. 4) The yield of maize and of stover per acre is materially increased by the number of cultivations. 5) It is plain that two cultivations are not sufficient to subdue the weeds; on the other hand it appears that it is not necessary to practice deep tillage when once the soil is properly prepared before seeding. The average yield of the hoed plot was the highest yield obtained from any other. Whether, however, from an economic standpoint, more than four cultivations would be justified would have to be determined by local conditions. Thus, for the years of severe drought the extra work would be profitable. The above data gathered and compiled by the Section of Cost Accountants show that cultivation operations cost, on the average, 18.7 cents per acre.

TABLE III—Result of Experiment on Number of Maize Stalks per Hill, Averages of Five Years 1906-11.

Stalks per Hill	1	2	3	4	5	6
Number of plots, each 1/4 acre	541.00	427.00	633.00	806.00	1,069.05	1,376.00
Stands per acre	17.60	17.30	13.60	96.33	104.33	268.33
Barren stalks per acre	3.00	4.21	5.93	14.30	21.35	23.15
Barren when cut, per acre	96.70	94.55	93.67	93.67	94.60	93.85
Stalks, inches per acre	82.30	80.60	81.00	78.33	78.33	74.33
Stalks, feet per acre	35.60	34.00	35.00	31.60	32.00	30.00
Stalks per plot, pounds	404.00	392.00	516.80	525.70	507.90	448.20
Marketable ears, pounds	241.83	275.95	288.75	247.75	185.87	129.25
Marketable ears, per acre	82.07	84.40	66.47	54.15	38.75	36.47
Weight of maize per acre	805.00	1,145.60	684.30	1,034.70	1,052.90	968.20
Maize per acre, bushels	59.57	42.90	58.18	55.92	53.92	44.69
Maize per acre, pounds*	3,520.83	2,827.87	3,508.90	3,630.47	4,394.47	4,663.17

* The results of 1911 are not included.

RELATION OF THE NUMBER OF STALKS PER HILL TO YIELD.—An experiment was proposed to ascertain the most advantageous number of stalks per hill. An enquiry made among the best maize growers in the State showed that the desired number of stalks per hill varies from

2 to 4. The number preferred in most cases is 3, and the average is 3.08.

The plan of the experiment conducted by the writer consisted of 6 plots to be planted annually to Minnesota No. 13, of uniform quality, and treated in the same way, only the number of seeds per hill should vary from 1 to 6. To secure the desired stand, extra seeds were sown per hill. When the plants were about 12 inches high they were thinned to the desired number of plants. The results of the experiment are set forth in Table III.

The above results show: 1) that not only the number but the percentage of barren stalks increases as the number of stalks per hill increases;

2) that the common assumption that thicker plantings result in greater loss in the number of stalks per hill is not borne out;

3) that the increased number of plants per hill has an effect upon growth;

4) that the same conditions also prevail and to a greater degree, the height of the ears on the stalks;

5) that the maximum yield per acre was reached with 3 stalks per hill, while 3 stalks per hill yielded only a fraction of a bushel less than 6 stalks per hill yielded more than 2 stalks per hill;

6) that in the yield of stover 6 stalks per hill gave the highest production per acre. The yield of stover increased as the number of stalks per hill, except for the drill row, which yielded practically the same as 3 stalks per hill.

Under the soil conditions obtaining at University Farm, 4.5 square feet of soil area per plant is sufficient under average conditions for maximum production. How far these results hold good for other localities is not known, but in general it may be concluded that three viable seeds per hill and a resulting stand within the limits of four will produce the largest yield of corn and a relatively high production of stover. For the production of ears 3 stalks per hill will give most satisfactory results. If, on the other hand, it is desirable to feed the crop in bundle to cattle, 4 stalks per hill would be preferable.

294 - **The Importance of Thick Seeding in the Production of Milo Sorghum in the San Antonio Region, Texas** HASTINGS, STEPHEN H. in Bulletin of the Department of Agriculture No. 188, 21 pp., 6 figs. Washington D. C., 1915.

Experiments carried out at the San Antonio Experiment Farm since 1900, and the results obtained by farmers in that locality, indicate that grain sorghum can be made a highly satisfactory crop in the San Antonio region if the proper varieties are grown and the necessary cultural methods are followed.

It appears that unsatisfactory yields are due in many instances to thin stands, which permit excessive tillering and this results in late and non-uniform maturity, and this is especially harmful as the successful production of sorghum depends upon the crop getting past the seedling stage before the appearance of the sorghum midge (*Contarinia sorghicola* Coq.).

CEREAL AND PULSE CROPS

Experiments with milo were conducted at the San Antonio Experiment Station in 1913 and 1914 to determine the effect of planting in rows of different distances apart and of thinning the plants to different distances apart on the tillering and branching, the uniformity and date of maturity and the yield.

The season of 1913 was very favourable for the production of grain crops, but the season of 1914 was particularly unfavourable.

Five of the experiments were as follows:

1. The distance between the rows did not cause marked differences in the number of tillers or the number of heads per plant.

2. The distances between the rows varying from 30 to 48 inches the number of mature heads per plant ranged from 2.2 to 2.8 in 1913 and from 1.4 to 1.68 in 1914.

3. The plots on which milo was sown in rows 4 feet apart and where the plants were thinned to different distances within the row the number of heads per plant decreased consistently as the spacing within the row decreased. The yield, however, increased slightly as the plants stood in thicker stands. In 1913 the rows that were not thinned and those thinned to 24 inches apart yielded 40.4 bushels per acre, while those thinned to 12 inches apart yielded 42.5 bushels per acre. In 1914 the rows not thinned yielded 1.2 bushels per acre and those thinned to 24 inches only 1.2 bushels per acre.

4. In 1913, 1914, counts were made of the number of stalks per row foot and at harvest time the number of heads per plant on the row was determined. It was observed that there was a decrease in the number of stalks per plant where the plants were crowded and that the practice of thinning is advantageous to the yield. The crowded plants, however, ripened about one week earlier than the widely spaced plants. The early maturity is particularly important in that it permits the crop to escape the sorghum midge.

5. Weather conditions influence very markedly the number of tillers and branches produced, although the total number of branches and tillers for 1914 about equalled the total number of tillers alone in 1913, there were but few branches.

6. The stand is controlled by varying the rate of seeding and by thinning the plants. The writer recommends sowing 5 bushels per acre where the rows are 4 feet apart.

It would appear that the close spacing of the plants can be practised in years of low rainfall. To offset this increase in the number of plants it is necessary only to increase the distance between the rows.

7. The time the plants are thinned does not seem to be an important factor in suppressing tillers and branches. If the thinning is delayed sufficiently to reduce tillering, there seems to be a tendency for the plants to produce a larger number of branches.

295 - Cultural Experiments with *Bromus arvensis* L. at Svalöv, 54-55
 WITTE HERNFELDT in *Skotska Lantbrukets Tidskrift*, Year XXV, Part 1, 1915, pp. 1-12.
 Stockholm, 1915.

When grown as a single crop this grass yields in the first cut more than any other forage plant. The yield of the second cut depends on meteorological conditions and the period of the harvest. In 1912, the first cut yielded 9 450 lbs. of grass per acre (3 791 lbs. of hay) and in 1913, 8 029 lbs. per acre. In these two years the crop was cut on 10-12 July and there was almost no aftermath. In 1913 the first cut was made on June 28, well in advance of the flowering period, giving a yield of green fodder per acre and an aftermath of 11 508 lbs. This was partly due to the fact that the first harvest was followed by heavy rain, 7.6 inches falling in 24 days. Thus this grass even when cut alone gives excellent results when the weather is damp and rainy.

Mixtures of *Bromus* with other forage crops in 4 different combinations were sown at the rate of 1.8 lbs. per acre. The results of the combinations were as follows:

Com- bination.	Amount of seed sown in lbs. per acre.							Yield of hay in tons per acre.			
	Clover.							Total of all plants.			
	Red Pine Red Swedish	<i>Luzerne</i> <i>hybrida</i>	<i>Ulex</i> <i>europ.</i>	<i>Trifolium</i> <i>pratense</i>	<i>Trifolium</i> <i>glaberrimum</i>	<i>Trifolium</i> <i>pratense</i>	<i>Alfalfa</i> <i>clavata</i>	<i>Bromus</i> <i>arvensis</i>	1st cut	2nd cut	total
I . . .	8.9	—	1.78	.89	3.56	3.56	1.45	1.78	5 642	1 968	7 610
II . . .	8.9	—	1.78	—	7.12	—	—	1.78	5 440	2 048	7 488
III . . .	—	8.9	1.78	4.15	2.67	—	—	1.78	5 793	1 838	8 631
IV . . .	—	8.9	1.78	—	7.12	—	—	1.78	6 726	2 003	8 729

Thus, the yield of the *Bromus* alone at the first cut is equal to 61 per cent of the entire crop whilst in the second cut it falls to 24 per cent. On the whole the yields of *Bromus* from 1.78 lbs. of seed are very satisfactory.

296 - *Panicum sanguinale* or False Cebadilla, a Wild Forage Plant in Paraguay.
 BERIOU, GUILLERMO TELL, in *Boletín del Departamento Nacional de Agricultura*,
 N° 84, pp. 104-105. Asunción, Paraguay, 1915.

Panicum sanguinale is one of the best wild forage plants in Paraguay. It is an annual of rapid growth and spreads rapidly. It succeeds on most diverse types of soil, but not in low inundated lands or very fertile or sterile soils. The forage is tender, palatable and of great nutritive value. It is very suitable for making hay which is very compressible. The plant contains about 80 per cent of water and in the dry state its percentage composition is as follows:

FIBRE CROPS

Oil	17.43	Fat	2.81
Protein	3.32	Cellulose	26.41
Moisture	29.75	Carbohydrates	43.32

As this plant is an excellent forage when obtained as a wild variety it hardly be recommended for cultivation on account of its spread and lack of resistance to treading down, and difficult harvesting. On account of its high moisture content it cannot be fed green.

Ginning as a Factor in Cotton Seed Deterioration SAUNDERS, D. A. *Report No. 1, U. S. Department of Agriculture, Bulletin No. 885*, 5 pp., 8 figs. (Washington: Government Printing Office, 1925).

A mixture of cotton seed is largely responsible for the rapid deterioration of cotton varieties which is so apparent throughout the cotton belt. Much to a large extent is directly traceable to the mixing of seed in gins. To measure the degree of mixture a method was devised by the writers, Mr. SAUNDERS, at Greenville, Texas. The results showed that in practice, unless special precautions be taken, mixing occurs in lots of seed cotton that successively pass through the gins in several parts of the machine: in the flues which convey the seed to the distributing, cleaning and feeding devices and in these latter only slightly. Extensive mixing takes place in the roll box. It is found that the seed corresponding to one bale of lint, obtained by ginning, frequently contained 14 to 16 per cent of the seed of a previously ginned and also a small quantity from the lot that preceded it.

This means that if different varieties are being ginned consecutively all will receive in the seed delivered to him at the gin an admixture of these varieties. If such seed is planted opportunity is offered for amount of cross-fertilization in the field and deterioration begins. The next ginning one or more other varieties may be added and in a poor improved variety may completely deteriorate.

Order to minimize the amount of mixing the following precautions should be taken:

Flues, feeders, and cleaners should be thoroughly cleaned before seed is allowed to enter them. The roll should be dropped from the box and the box should be thoroughly cleaned. The next step is to prevent the seed from falling into the conveyor. It is impracticable to clean the conveyor satisfactorily and therefore it should not be used. The best seed is to be obtained. By adjusting the position of the seed box the seed can be made to fall upon the floor instead of into the conveyor. From here it can be sacked easily. The floors about the gin should be cleaned and canvas is often spread on the floor to receive the seed.

These precautions require time and will increase somewhat the cost of ginning, but the advantages gained will amply compensate the extra expense of special ginning may be reduced by arranging to gin late in the close of the season when more time is available.

298 - **Seasonal Variations in the Storage of Plant Food in *Hevea brasiliensis* and their Relation to Resting Periods.** — CAMPBELL, L. E. (Rubber Res. Department of Agriculture, Ceylon, *Bulletin No. 22*, pp. 1-18, Diagr. I-VI, Ceylon, 1915).

Investigations on the question of seasonal variations in the storage of plant food were begun in November 1913 in view of the importance of the subject in its bearing on the cessation of tapping during leaf change. Six trees were selected out of a row of 30 with an average girth (25.9 inches at 3 feet) and the method of examination was by means of the starch-iodine test of sections of bark and wood from former investigations (1).

No considerable variation was found in the amount of starch stored in the bark and wood from November up to the time of leaf fall. When the trees were leafless the amounts of starch stored in the wood showed no signs of decreasing, but a large withdrawal from the bark and wood to a depth of $\frac{1}{2}$ inch from the cambium when the new leaves were attaining their full size. Recovery began within three weeks of the time that the new leaves were formed and this recovery continued until June.

Twenty three of the trees in this row were tapped continually during the experiment and yielded rubber as follows:

Grammes	
November	7.44
December	7.88
January	10.73
February	7.64
March	4.47
April	4.03
May	7.44
June	7.88
July	10.73
August	7.64
September	4.47
October	4.03

Leaf fall occurred during February and the trees were bare during the first and second weeks of March. New leaf formation continued until the end of April. The decrease in yield during March, April and May corresponds to the amount of starch found in the wood and bark during these months.

In Ceylon the general practice with regard to tapping during leaf fall period is as follows:

1. Most estates cease tapping for some period whilst the foliage is changing.
2. The period of rest generally extends from the time of the fall of the old leaves to the time of full development of the new leaves and is usually 4 to 6 weeks.

These investigations show that the recovery does not begin until one or two weeks after the full development of the leaves and even a reserve food supply is not sufficient to justify a recommencement of tapping (2).

(1) See *B. Sept.* 1915, No. 917.

(2) See also *B. Dec.* 1915, No. 1287.

It appears that the rest period in Ceylon occurs too early. The rest time is from the appearance of the new leaves until 3 weeks after the development of the foliage has been obtained.

Experiments Made in Denmark on the Seed Time of Sugar Beets (Møllehavegaard, 1915, *Udvalgte Forsøgsresultater i Plankultur, 1915 - Udsæet i et Plankult.*, Vol. 2, pp. 101-104, 175, Copenhagen, 1915).

Experiments were made during 1900-1; at the Experiment Station, Lolland, Southern Denmark on a loam soil previously unworked.

The average results are summarised in the following table:

Yields of Sugar Beets sown at different periods, 1900-1.

Date of sowing	Yields per acre		Sugar content	No. of plants in 1st Year
	Beets	Sugar		
	lb.	lb.	per cent	per cent
March 10	32,134	5,977	18.4	10.7
March 20	32,033	5,077	18.2	2.0
March 30	30,604	5,710	18.7	0.3
April 10	27,098	5,085	18.4	0.1

From these results it follows that mid April is the most suitable time for sowing the soil for sowing about the 20th of the same month. Furthermore it would be better to postpone sowing till some days later.

Loss in Tonnage of Sugar Beets by Drying (SHAW, EMORY B., Assistant Pathologist and Truck Disease and Sugar Plant Investigations, in *Fieldwork of the University of California*, No. 160, 12 pp., 1915, Washington 1915).

LOSS OF BEETS PULLED BUT NOT TOPPED.—At Ogden, Utah, October 20, 1912, the writer dug and pulled several rows of beets. The beets were weighed (10 a.m.) then again at 1.50 p.m., at 3.30 p.m. and at 10 p.m.; between each weighing they were spread out on the ground. It was found that in the 24 hours the beets had lost 10.32 per cent of their weight, namely 7.1 per cent between the first and the second weighing, 2.92 per cent between the second and third and 0.42 per cent between the third and fourth. During this experiment the mean temperature was 50° F.

LOSS OF BEETS PULLED, TOPPED AND LEFT IN RATHER SMALL PILES.—The morning four other rows of beets were dug, pulled and topped as far as possible. The tops and beets were weighed separately. The beets were thrown in small open piles according to a common practice of the growers and the tops were laid in a single windrow. The mean temperature during this experiment was 50° F. The experiment was repeated the following day, the mean temperature during this experiment was 52° F. The results were as follows:

in the large uncovered piles the mean daily loss during the first 10 days was 0.62 per cent, and in the covered piles 0.60 per cent. These figures are higher than in the case of small piles or when the beets are spread out.

EFFECT OF DRYING UPON THE SUGAR CONTENT OF BEETS.—From some beets taken from a silo a diagonal core was rasped out for analysis. The same diagonal core was rasped out after the beets had been exposed for 10 days to a brisk current of air. It was found that the percentage of sugar increased as the water was withdrawn by evaporation and that ripening and decomposition took place even during so short a period of exposure. In 10 days, the time covered in this series of tests. This inversion of the sugar takes place when the delivery of the beets is delayed from 1 to 7 days after they have been dug and topped, but it should receive consideration when the grower has to silo his beets for weeks or months.

LOSING OF SUGAR BEETS IN VERY LARGE OPEN PILES.—About 100 tons of beets were placed in three adjacent piles, containing respectively 35 tons, 20 pounds, 10 tons, 17,000 pounds, and 28 tons, 100 pounds. They were weighed at Ogden during November 23, 4 and 5, 1912. They were again weighed until January 4, 1913 when they were again weighed. In 10 months they lost 4.1 per cent. The mean temperature during the period was 36.7° F., and the rainfall 1.42 inches.

Effects of Attacks by *Cercospora beticola* on the Composition of Sugar Beets. (Continued from this Bulletin)

Method of Drying of Kentucky Tobacco.—*FRANCESCO MARCONI*, *Annali di Chimica e Fisica, Rendiconti delle Reali Accademie dei Lincei, Roma, 1912, Vol. XIV, No. 59, 580-584, September-December, 1912.*

Italian tobaccos even after the most careful drying tend to absorb moisture from the air. This hygroscopicity of leaves may result in a loss of value and their suitability for the making of fermented cigars. The hygroscopicity varies with different tobaccos, some being able to retain 10 per cent of moisture without deterioration, whilst others deteriorate at 5 per cent of moisture. As a general rule, it may be said that 10 to 15 per cent of moisture may be retained without deterioration in most tobaccos but that 20 per cent should not be exceeded even in the most resistant tobaccos.

In the usual drying method the tobacco is dried to a degree exceeding 10 per cent, but before packing the tobacco is liable to absorb an amount of moisture equal to 2.2-2.3 per cent or more.

In view to a study of a method of reducing the humidity of 17 to 20 per cent, according to the variety, the writer summarises the conclusions of the studies made in all parts of Italy during the past 26 years.

Some Italian Kentucky tobaccos require, in addition to careful natural drying, artificial drying immediately before being packed.

When artificial drying it is necessary to produce an artificial reabsorption of moisture until the leaf tissue becomes supple whilst the midrib remains dry.

3) Tobacco when thus treated not only keeps better but is also more acceptable to the consumer.

4) The cost of this additional treatment is largely covered by the higher price obtained.

303 - **New Experiments Carried out in 1914 at the Medicinal Plant Station at Kolozsvár (Hungary)** (1). — I. PÁTER BELA in *Készlet*, Bulletin of the Agricultural Stations of Hungary Vol. XVIII, Part. 3, 147-150, 1915. II, *Ideem* - On the Degeneration of the Species of Mint Cultivated in Hungary, pp. 625-635, 8. figs.

I. — *The continuation of experiments on:*

1) The cultivation of roses for essential oil; 2) sowing of medicinal plants; 3) artificial propagation of *Claviceps purpurea*; 4) manuring of *Mentha crispa*; 5) the acclimatisation and manuring of "Mitcham" peppermint (*Mentha piperata*) imported from England; 6) acclimatisation of Japanese mint; 7) manurial experiments with *Urtica officinalis*; 8) manurial experiments with *Ononis benedictina*.

These experiments have established the following facts:

1) Many species of roses grown for essential oil (*Rosa rugosa*, *R. trigintipetala*, *Rosa centifolia*, *Rosa moschata* and *Rosa rugosa*) were cultivated in the open. The last of these varieties gave much the best results because it was the most easily propagated.

2) Many plants with minute seeds that have hitherto been sown in nurseries, succeeded well in the open; these were: *Digitalis purpurea*, *Galium Majorana*, *Lula Helianthum*, *Rheum* sp., *Salvia officinalis*, *Scutellaria*, *Valeriana officinalis*, *Pyrethrum cinerariaefolium*, etc. The sowings of *Hyoscyamus* and *Datura Stramonium* succeeded better in spring sowings which were generally a failure.

3) Experiments on the artificial propagation of ergot (*Claviceps purpurea*), were successful when the sclerotia were sown in the open; when they were cultivated indoors the spores did not germinate. Of the sclerotia sown, only those buried in the ground to a depth of 2-3 cms. germinated, any sown at a less depth, or on the surface of the soil, did not germinate. On a plot of 2 sq. metres, ergot was produced by artificial infection on 100 ears of rye.

4) The manurial experiments with *Mentha crispa* gave excellent results: a 40% potassic fertiliser applied alone increased to a considerable extent both the green crop and the yield of essential oil. The essential oil of plants manured with potassic fertiliser was clearer and more plentiful than that obtained from plants fed with phosphatic and nitrogenous manures had been used, whether separately, or mixed.

5) The experiments made with the Mitcham variety of peppermint were very successful. This variety gave better results than *Aguilliana*. The manurial experiments proved that a mixture of phosphatic, nitrogenous and potassic fertilisers increased the yield of essential oil.

See: *B.*, December 1913, N° 1315; *B.*, January 1914, pp. 27-31. The Cultivation of Medicinal Plants in Hungary - by Dr. Bela Páter

	Cases	Weight
	—	—
Summer crop (February-March), 1911	928	28
Winter (June-October), 1911	176	6
Total yield	1124	34

In addition to these 1124 cases exported to Brisbane about 1000 were sold or consumed locally.

A plantation of "Smooth pine" of one acre gave in the year 1911 225 cases as a summer crop and 182 cases later, as a winter crop.

The prices of pineapples at Brisbane in October were: "Queen" 11/- per case; "Ripleys" 9/- to 11/- per case; "Common" 8/- to 10/- per case. The retail prices were "Ripleys" 8/- to 9/- per dozen; "Rough" 7/- per dozen; "Smooth" 3/- 6 6 per dozen.

These yields, checked by the Superintendent of Fruit Culture in Queensland Department of Agriculture are the result of careful cultivation and rational manuring, and are therefore not to be considered exceptional.

305 - **A Suggested Explanation of the abnormally High Records of Doubles Gained by Growers of Stocks (*Matthiola*).** - SAUNDERS, EDITH R. Lectures, 1912, Cambridge College, Cambridge in *Journal of Genetics*, Vol. 5, No. 2, pp. 137-141, Dec. 1915.

During recent years the writer has obtained considerable evidence to show that the actual output of doubles among the strains of stocks in cultivation does not exceed 50 to 57 per cent. Florists lists still advertise strains capable of yielding 80 per cent of doubles.

Additional evidence is produced to show that the greater the number of the double producing seeds, as compared with the single, will be the increased output of doubles.

A certain gardener isolated a strain of white stocks which gave the following results in his flower beds during 4 years:

	Singles	Doubles
	—	—
1911	28	194
1912	17	93
1913	30	180
1914	55	216

A control experiment was carried out with seed of this strain collected in 1911. Every seedling produced was grown until it flowered and to avoid any sort of partial record. The result was 185 singles and 204 doubles, or about 55 per cent., thus proving that this strain behaves exactly like other strains when completely grown.

When the seedlings were classified according to their vigour the proportion of doubles varied from 75 per cent. in the most vigorous group, 40 per cent. in the least vigorous groups.

The Effect of Various Dressings on Pruning Wounds of Fruit Trees. HOWE, C. B.
California Agricultural Experiment Station, Bulletin, No. 206, pp. 83-4, Geneva, N. Y., 1911.

A series of experiments, begun in 1911, with different substances applied to the pruning wounds of fruit trees, in order to determine the effect of the various materials in accelerating the cure of the injury and their preservation against the attacks of fungi and injurious insects. These experiments were made on apple trees (as representative of the pome fruits) and peaches (as representative of stone fruits). The following substances were employed: white lead, white zinc (both mixed with linseed oil), creosote, coal tar, shellac and *Avenarius carbolineum*. They were applied at different times of the year, to pruning wounds of various sizes, some inflicted and others of some weeks' standing. The effects were compared both in the case of the treated wounds and in that of those which were left open, at the end of the first and the second season of growth. The principal results were as follows:

In all cases the untreated wounds healed more rapidly than those protected by any of the substances enumerated. Amongst the latter, shellac, during the first period of growth, to exercise a stimulating effect on the development of bark around the wound; this effect, however, was not observed during the second period of growth. Shellac caused the least injury to the cambium, but, on the other hand, it had the least adhesive power. *Avenarius carbolineum* and yellow ochre did so much harm to the cambium, in the writer's opinion, they should never be used for covering pruning injuries. The lesion produced by coal tar was less serious, but it was more quickly absorbed and evaporated. White lead and white zinc also produce a slight injury to the cambium when they are first applied, but these tissues soon recover, and at the end of the first growth period hardly any trace of injury is visible. White lead and white zinc were the most efficacious of all the compounds used, and the former was the better of the two.

It is gained by waiting some weeks after pruning before applying dressings.

The substances used in the experiments in treating the pruning injuries of apple trees produced such damage to the wood, that the wounds did not heal. Consequently these substances should never be applied to the wounds of the peach; this probably applies to all other trees with stone fruit. In all cases were the wounds, whether open or protected, observed to be attacked by fungi. As the substances used seemed rather to retard the healing of the wounds, it may be concluded that the treatment of injuries of fruit trees is, to say the least, useless. Nevertheless, had the experiments been carried further, it is possible that they might have exercised a useful influence on the healing of very large injuries; this however still remains to be seen.

397 - **Soils of Massachusetts and Connecticut, with Especial Reference to Apples and Peaches** --- WILDER HENRY J. (Scientist in Soil Survey) in *U. S. Department of Agriculture, Bulletin No. 210*, pp. 73, plates 21. Washington, April 1918.

This is a study, for Massachusetts and Connecticut, of the present, probable, general conditions of orcharding and its future, methods of growing, connection between the character of the soil and its suitability to the different varieties of peaches and apples. This latter is summarized by the writer as follows :

Under cultivation, mellow loams and fine sandy loams overlying clay loams of friable structure excel for the Baldwin. Under the same conditions *Rome Beauty* thrives further south, where the climate is warmer. Heavy silty loam or light silty clay loam with subsoil of fine sandy loams and warm mellow loams, excel if a high degree of fertility is desired.

Soils favouring the Hubbardson are rich fine sandy loams or loamy fine sands with subsoils of fine sandy loam or mellow loams.

For the Northern Spy and the Wagener, a mellow medium loam underlain by heavy loam or friable light clay loam is desirable, but the use of humus and the application of ammonia carrying fertilizer is much greater for the Wagener than for the Northern Spy.

The heavier of the soils described for the Baldwin seem preferred for the McIntosh.

For Tompkins King and Gravenstein, an open textured loam, lighter than a fine loam, with a subsoil of the same or only slightly heavier is preferred. While similar soils are excellent for Ben Davis, it is believed that these varieties should be grown outside of New York.

Both the Tompkins King and the Northern Spy soils grow well in suits with the Fall Pippin.

A deep rich loamy soil with subsoil of at least medium productivity, preferably a sandy loam, is excellent for Roxbury.

Soil adaptedness under Connecticut conditions, to some of the commercial varieties of peaches, is as follows :

Champion succeeds best on soils of only medium productivity but should be deep and well drained. Medium to heavy friable soils underlain by material not heavier than a friable loam and preferably heavy sandy loam, are very desirable.

Carman and Mountain Rose succeed best on soils somewhat lighter than the Champion but still deep and well drained. This soil type seems typically supplied by the loams of the Wethersfield and the field series.

The Elberta and the Belle prefer stronger soils than the Carman and the Mountain Rose. Loams, silty loams and silt loams, with subsoil of similar material, seem best to meet these requirements under Connecticut conditions.

For Late Crawford, a fairly strong soil, such as a light peat or somewhat less retentive of moisture than the heaviest of the Elberta is desirable.

of the early varieties, such as Greensboro, are less sensitive to frost conditions than the varieties mentioned above.

Report on New or Noteworthy Fruits by the New York Agricultural Experiment Station, Geneva, N. Y., United States. — HEDDERICK, C. P. in *New York Agricultural Experiment Station Bulletin*, No. 203 (1901), p. 1-120. Geneva, N. Y., April, 1901.

This is the third report on new or noteworthy fruits from the New York Agricultural Experiment Station. The Station aim is that of testing varieties offered on the market and recommended by the New York Government. The following numbers of varieties were being grown in 1900: apples, 412; pears, 276; quinces, 18; peaches, 304; nectarines, 34; plums, 12; cherries, 60; grapes, 404; currants, 33; raspberries, 41; blackberries, 41; gooseberries, 63; strawberries, 14; total named varieties, 2,301.

In describing the new varieties, the writer has found it necessary to make a preliminary statement on the relative value of new and standard varieties for commercial planting, as the varieties described in the first two reports on new fruits have evidently not been viewed in the right perspective by some of the readers.

The tendency on the part of many commercial fruit growers is to grow on a large scale the sorts recommended as promising in this bulletin, without bearing in mind that, no matter what the merit of a fruit may be, it is often difficult to market it advantageously. A variety must be looked upon as a speculation or as an experiment, and a good fruit grower should let new varieties stand the test of time, before their value — in other words, become "standard." Before growing them extensively. — Standard varieties, for which the demand is constant, should therefore form the basis of every good commercial orchard, although a few plants of a few new varieties may also be grown.

Niagara is a variant of the *Crawford* peach. This group, the dominant type, is a little too capricious as to soil and climate to please the tastes of commercial fruit growers, failing to bear regularly or abundantly, but particularly good peach soils.

The best of the group is the *Niagara*. It ripens early in September, is yellow, with a handsome overcolour of red. The flesh is yellow, firm, with a rich sweet flavour which makes it one of the most desirable peaches of its season. It is, as most of its type, a freestone. Its chief point of merit, as compared with other *Crawfords*, is that it is less capricious as to soil and climate.

Muscat Hamburg is known in America and, especially in the United States, as a hot-house variety, the best adapted for forcing, but has proved itself to be also the best *Vitis vinifera* for outdoor cultivation in New York State when grafted on roots resistant to phylloxera, and given only some protection during the winter by covering lightly with straw. It will grow and bear regularly alongside of Concord, *Niagara* or *Chautauque*.

Lambert originated in Oregon and is now a standard variety

in its native State but is still on probation in eastern America. The Bigarreaut, a seedling of Napoleon by Black Heart. The tree, for its vigour and health, and the fruit, for its beautiful purple colour and juicy flesh, are both valued very highly. It is well worth testing for home or market, and should find congenial soil and climate in many of New York State.

Plum.—The *Late Mascatelle* plum has been tested for ten years at Geneva Station and has come to be regarded as one of the best plum out of the 500 or more that have been fruited with it. The plum tends in shape and of a beautiful purple-brown colour slightly tinged with russet. The flesh is tender, meaty, firm, juicy, sweet and crisp. As a culinary fruit it can hardly be surpassed. For home use or market trade it is certain to prove a valuable variety.

Gooseberry.—*Industry* is the most popular of all English gooseberries. The bushes are strong, stocky, vigorous growers and most productive. The greatest fault with this, as with all English varieties, is that they tend to mildew. The berries are of large size, roundish oblong, rather of poor quality. Good for preserving and canning. It is worth being generally planted.

390. The "Aribaud" Peach; A New Variety from France. DESMOUTIER, *Revue Agric. de la France*, 1904, Year 17, No. 2, pp. 41-48, Villefranche, Rhône.

The "Aribaud" variety of peach (obtained by Dr. Aribaud, Villefranche, Rhône, France) has, for some years, been much cultivated in that part of the Rhône valley lying between Vienna and Saint-Rambert. Owing to its vigour, its foliage and fructification, as well as the size of its fruit, this peach should be undoubtedly classified among the late varieties and comes probably from a plantation of "Precoce de Nîmes" in which the trees were used as grafting-stocks.

The "Aribaud" peach tree is very vigorous and prolific; it bears very large, weighing on an average from 5½ to 7 ozs. (some peaches weighed as much as 10½ ozs.); they are well-shaped, round and very firm, therefore travel well. The kernel is quite detached from the pulp. The colour of the fruit is fine, although of a duller red than in other varieties; the pulp is white, of excellent quality and very juicy. In the mentioned region, the peaches ripen, on an average, between the 15th of August. The "Aribaud" peach tree is somewhat exacting to soil, which must be rather deep and fertile; it cannot resist frost, which causes the fruit to fall. It is best planted 1½ × 1½ ft. up to 1½ × 16 ft.

The writer recommends the cultivation of this peach, especially in commercial orchards, for purposes of export.

Observations Upon Direct Bearers in the Vaudois Vineyards (Switzerland).

By the Journal of the Physiological Section, and PERCIVAL F. HODGKIN, the Chemical Section, of the Vine-Growing Station at Lausanne, and F. *Observations sur les Plantations Directes dans les vignobles Vaudois*, 1913; Lausanne, Imprimerie Vaudoise. — II. *Le Travail de la Vigne*, Year 32, Nos. 33-35, 37-39, pp. 188-191, 219-221, 284-286, 300-301, 311-312, August 15 — September 26, 1915.

A summary of a large amount of evidence collected since 1900, with assistance of the Staff of the Lausanne Viticultural Station.

Researches made of late years have often led to the conclusion that vines are adapted:

(1) especially to regions where mixed crops are grown, and where pruning and harvest operations are often accompanied by the use of sulphates and sulphur mixtures;

(2) to vineyards where the damp climate does not permit very frequent sowings with sulphur.

Since many of the Swiss vineyards are situated under such conditions, it appears *a priori* that they could be planted with direct bearers.

It is, however, not the case, for in the Swiss, and more particularly the Vaudois vineyards, the substitution of hybrid direct bearers for native vines can only be effected satisfactorily under the following conditions:

(1) The direct bears must above all be resistant to fungoid diseases, and, possibly, to phylloxera.

(2) In the case of a Romand vineyard the direct bearer must, in order to supply grapes and wine similar in character and qualities to the native vines it is to replace; these are practically reduced to two varieties, and "petit pinot" varieties.

It is asking a good deal, but these requirements are justified. In a vineyard, the Swiss vineyards produce a *little less than half* the wine consumed in the country; the native products, which are greatly exposed to foreign competition (for foreign wines under the present Customs regulations can be bought cheaper than Swiss) can only hold their own thanks to special characters, which justify the marked preference shown to them by the native consumer. In order to insure their further existence in the Swiss vineyards must first of all maintain the special characters of their products which enable them to compete successfully with foreign wines on the market, even when these are sold at lower prices.

The Viticultural Station at Lausanne being particularly anxious to avoid any injury to the quality of the native wines by the haphazard introduction of direct bearers into the Vaudois vineyards, has made practical investigation of the principal characters shown, under the climatic conditions of the Canton de Vaud, by a certain number of hybrid direct bearers. These were kept under direct observation in the Experimental Vineyards of the Station. These vineyards, which are 8 in number, differ greatly in soil and exposure, have each an area of about 32,000 m², and are divided into 3 plots planted as follows:

(1) I. — "Chasselas fendant" grafted on the series of different

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(2) II. — The direct stocks bearers of most interest to the region.

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Plot III. — Native ungrafted vines serving as controls.

The results obtained may be summarised as follows:

RESISTANCE TO MILDEW. — This in most direct bearers is superior to the resistance shown by *Vitis vinifera*. It varies enormously from one number to another and from one year to another. It is very pronounced in old direct bearers such as Noah, Duchess and Huntingdon. It is considerable in the series Riparia \times Gamay Nos. 595, 604, 605, 701 and 702; considerable in Seibel Nos. 1, 712, 2003, 2007, 2003, 4444; Condere 146-51; Castel 1028. Unfortunately, this quality, possessed by hybrid direct bearers, of resistance to mildew is often balanced by serious defects, such as with wrong flavour, (Noah, Duchess, Huntingdon, Seibel 712 and 713; Castel 1028), or too acid (Seibel 2003, 2007; Condere 146-51) or too green (Oberlin 505, 604, 605, 701). Seibel 2007 has the well-known defect of maturing its wood anything like sufficiently.

RESISTANCE TO OIDIUM. — Under unfavourable conditions the following stocks are very susceptible to Oidium: Seibel 713, 880, 1028, 2704, 3858; Condere 74-17, 82-12, 89-82, 106-46, 117-3, 108-80, 141, 272-00, 343-14, 4401; Malègue 148-4, 292-1, 314-15; Castel 14539 and 14539; Bertille Seyve 139 and 413; Oiseau rouge. As a rule, oidium seems to be a formidable enemy of a large number of hybrid direct bearers; some of the latter lose their leaves on coming into contact with the smallest amount of sulphur.

GRAPES WITH IMPERFECT FLAVOUR. — These are very numerous. The following vines especially have this defect:

Seibel 21, 62, 69, 78, 117, 254, 621, 645, 712, 793, 802, 803, 804, 1060, 2076, 2822, 2870, 2881, 2802, 4132, 4145, 4444; the Condere 2401 and 343-14; the Castels 1028, 1113, 19002; Bertille Seyve 139, 184, 211, Gaillard 2; Noah, Plant des larmes, Viennois, Plant Fournier, Black Huntingdon, Hybride franc, Delaware. In some years the box-scented flavour of these grapes is much more marked than other years and it depends on the degree of maturity attained by the fruit.

DIRECT HYBRID BEARERS REGARDED AS UNSATISFACTORY FOR VARIOUS REASONS.

Taste too insipid: Seibel 42, 130, 131, 215, 242, 426, 778, 2030, 24439, 7501; Condere 267-27; Bertille-Seyve 138.

Extreme acidity, or lack of sugar: Seibel 2, 138, 175, 404, 721, 2785, 3858; Condere 81-22, 90-38, 136-4, 146-51, 198-21; Castel 151, 13510; Bertille-Seyve 236; Oberlin 701; Jurie 580; Oiseau bleu; Oiseau rouge.

Mixed pink and green grapes: Seibel 1, 450, 452, 716, 835, 2020, 712; Condere 28-112; 71-01, 106-51, 4401; Jouffreau; Plant des Paroles; Le cante \times Terras.

Grapes too small, or bunches too loose: Seibel 477, 2573, 2041, 27, 2770; Oberlin 505, the wine of which is much to be recommended in every respect; it is of a fine colour, and has a pleasant fruity flavour.

DESIRABLE BEARERS CONSIDERED AS OF INTEREST WITH REGARD TO THE
 CONDITIONS OBTAINING IN THE VAUDOIS VINEYARDS.

After the removal of the unsatisfactory bearers, there remain out of 25 direct bearers that had been kept under observation only 14 (8 black and 6 white) which give hopes of more promising results. These are the same. *Black*: Seibel 156, 782, 2003, 2006, 2007, 2063; Condere 7104, 2004. — *White*: Seibel 880, Condere 88-51, 117-3, Castel 1028, 1029, 157, Duchess.

They show the following characters:

Seibel 156. — Fairly good resistance to fungoid diseases; production average; sugar (in different vineyards and seasons) from 11.3 to 23.3‰; acidity from 7.0 to 25.0 gms. per litre. Wine coloured, brilliant, clean and light 9.2‰ of alcohol; 8.7 gms. of total acidity, and 30.1 gms. of extract per litre (after 1 year in bottle).

Seibel 782. — Good resistance to fungi, very productive, somewhat acid, at average of 2 years 12.05‰; total acidity 16.05 per litre. Wine a trifle acid some years.

Seibel 2003. — Resists disease well, good yield; large grapes, rather small. Sugar 9.3 to 15.6‰; acidity: 12-18.5 gms. per litre (3 different years). Sometimes well balanced; occasionally too acid and watery.

Seibel 2006. — Fairly resistant to fungi; large grapes; vinous, but a trifle. Sugar (in different seasons and places) varies from 8.6 to 22.0‰; acidity 7.8-22.6 gms. per litre. Wine light, usually well balanced and soft.

Seibel 2007. — Large grapes; heavy yield; ripens its wood very badly; resists fungoid disease well; sugar 10 to 10.7‰; acidity: 7.8 to 25.3 gms. per litre. Vines light, sometimes with pleasant taste, some years extremely dry and acid.

Seibel 2063. — Large grapes; moderate yield, good resistance to fungoid disease; sugar 12 to 18.4‰; total acidity: 9.0 to 15.3 gms. per litre.

Condere 7104. — Fairly acid; large grapes; a little attacked by Oidium; 11.8 to 18.9‰; total acidity 9 to 20.3 gms. per litre.

Condere 604. — Sweet and highly coloured, but with very small grapes and low yield. Good resistance to fungoid disease, sugar: 20.6 to 33‰; acidity: 6.7 to 15.8 gms. per litre. Good wine; alcohol: 11.8 to 12.5‰ (in 1911, 1912 and 1913); total extract: 22.6 to 34.4 gms. per litre; total acidity: 6.2 to 8.3 gms. per litre.

Seibel 880. — Fairly resistant to fungoid disease; sweet, pleasant. Sugar 20.1-22.2‰; total acidity: 7.6 to 11.6 gms. per litre.

Condere 88-51. — Resists fungi well. Good yield. White, rose-coloured taste, grapes small. Sugar: 14.9 to 18.8‰; total acidity 7.3 to 22 gms. per litre. Wine fairly good.

Condere 117-3. — Rosy white. Slight caramel taste; pulpy, but sweet; grapes small; yield rather small. Resists mildew well, but is much attacked by Oidium. Sugar: 13.8 to 25‰; acidity: 3.9‰ to 17.1 gms. per litre.

Fairly good wine, rich in alcohol and extract, of normal acidity, slight mel flavour.

Castel 1028. Sweet, large grapes, slight foxy-musk taste, good resistance to fungoid diseases. Sugar 15.1 to 19.9 %; total acidity 12.4 gms. per litre, normal wine; the 1911 vintage contained 12.2 %; extract 17.8 gms. per litre; ash 1.34 gms.; total acidity 12.2 %.

Gaillard 157. Rosy in warm years, plentiful yield; moderate grapes. Sweet, somewhat flat flavour recalling the grapes of the native variety. While distinctly more resistant than the native vines to mildew and oidium, as well as from *Cochylis*. Sugar 11.5 to 12.5; total acidity 5.4 to 17.6 gms. per litre. This is the direct bearer; under the conditions of the experiments, most nearly resembles the native variety and its grapes might be mistaken for those of the native vine, of elegant taste much resembling those made from Chasselas grapes, favourable years nearly identical, in bad seasons inferior.

Duchess. Sweet, flat, average yield; good resistance to diseases. The following conclusions are drawn:

None of the direct bearers that were the subjects of the experiments possess all the necessary qualities enabling them to be recommended to wine-growers of Roman Switzerland as substitutes for the wines on which their present reputation is based.

However, the real progress made in this direction allows us to say that the steady researches of those engaged in hybridisation experiments, one day provide the Vinobis vineyards with a sufficient number of vines which satisfy the requirements of the special conditions obtaining; therefore not rash to admit that the results hitherto obtained by the same Viticultural Station in its experimental vineyards are an encouragement to continue the study of the best numbers of hybrid direct bearers.

311 **Testing Grape Varieties in the Vinifera Regions of the United States** (by George C. Connelley, in Charge of Viticultural Investigations, U. S. Department of Agriculture, Bulletin No. 209, 15 pp. 19 tables, Washington, August 6, 1910).

A résumé of the viticultural investigations in the Vinifera region of the United States up to 1910 was reported in *Bulletin 172 of the U. S. Department of Plant Industry*. This *Bulletin* No. 209 supplements that work and contains additional data on the following subjects:

1. A comprehensive test of the resistant varieties of vines to determine their adaptability to the different soils and climatic conditions.
2. A study of the congeniality of Vinifera varieties to the different resistant stock varieties.
3. A study of the behaviour of fruiting varieties to determine the best suited to the different localities.
4. A consideration of all classes of grapes with reference to resistance to destructive insects and diseases and, if found necessary, origination of an entirely new class of grapes better adapted to the coast conditions.

To afford facilities for solving these problems, the Bureau of Plant Industry has established 12 experiment vineyards in various parts of

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The total average of these vineyards amounts to 51.3 acres. The following tables setting forth:

1. The average of each vineyard and the number of resistant vines, direct producers, viníferas on their own roots and viníferas on resistant stocks planted in each.

2. The temperature and rainfall at the twelve experiment vineyards.

3. The cultural data of fourteen American species of grapes whose vines or hybrids are under test as resistant stocks in the said vineyards.

4. The growth rating of resistant and direct producing varieties grown in the vineyards.

5. The best growth records and relative merits of resistant-stock vines in each of eleven of the vineyards.

6. Varieties of American native and Franco-American grapes grafted on their own roots in eleven of the vineyards.

7. Relative behaviour and value for different purposes of grape vines tested by grafting on resistant stocks and by growing on their own roots.

8. Relative behaviour and value for different purposes of improved American and Franco-American varieties growing on their own roots.

From the abundant material thus collected and elaborated, the following are some of the conclusions drawn:

1. Different species used as stocks with the same variety grafted on them increase or diminish its vigour and productiveness; increase or diminish the quality, size and appearance of the fruit; cause it to ripen earlier or later and bring about results varying from perfect success to almost complete failure.

2. Extensive saccharine and acid determinations made of varieties grafted on resistant stocks and contrasted with the congeniality and growth rates made of the same vines the same season, show a close correspondence between these important chemical constituents of the fruit and the congeniality of graft and stock. Similar growth ratings of a variety grafted on these stocks are found to be accompanied by fairly definite percentages of sugar and acid. The congeniality of the variety to the stock materially affects the resistant qualities of the stock.

3. The quantity and quality of the fruit are usually in opposition on the same vines producing most abundantly; the fruit is usually not of so high value per given unit as it is on vines that are relatively less productive.

4. Most vine varieties making perfect growth on resistant stocks are found to yield heavier crops than the same variety when grown on its own roots.

5. Cuttings of many hybrids root easily, although the cuttings from one parent may be hard to root.

6. Where conditions are not suited to a given species, they are often well suited to hybrids of that species with some other species.

7. As cuttings of *Monticola*, *Berlandieri*, *Aestivalis*, *Lincecumii*, *Bicolor* and *cordifolius* are hard to root, they should be rooted in the nursery and then there, or planted in the vineyard and grafted afterwards.

Riparia cuttings root easily and are excellent stocks well adapted for vineyard and bench grafting, but they are adapted to but few soils. Soils in which Riparia varieties thrive usually produce large crops of only fair quality.

Rupestris cuttings root and graft easily and are best adapted for bench grafting. When so used the dormant eyes should be cut out of the buds. Many varieties are not congenial to Rupestris, and their fruiting is somewhat later in ripening than when grown on some other stock.

In most instances Riparia, Berlandieri, Champini, and Aestivus are congenial to Vinifera varieties. Their fruitfulness is increased and time of ripening hastened in comparison with the same varieties on other stocks.

Some of the hybrid resistant stock varieties are making excellent cords as stocks under California conditions.

LIVE STOCK AND BREEDING.

312. **Experiments in Vaccination against Anthrax**—EICHORN, ALBERT. Pathological Division, in U. S. Department of Agriculture, *Bulletin No. 20*, p. 17, Washington, December, 1913.

The writer describes the production of anti-anthrax serum and the methods followed for determining its potency. He notes the disadvantages of vaccination by the PASTEUR method, among which the unstable quality of the Pasteur vaccine. In experiments conducted by the Bureau of Animal Industry of the U. S. Department of Agriculture it was found that in some instances a vaccine remained potent for a year, in other cases proved inert within three months of its preparation.

The writer carried out the following experiment:

On September 8, 1914, two horses were vaccinated against anthrax according to Pasteur's method. On September 29 their hyper-immunization began by giving them approximately 0.01 of a loopful of virulent thrax bacilli subcutaneously and was continued as follows:

Date	Amount of virus given each horse
Oct. 21	1 loopful
Nov. 18	10 loopfuls
Dec. 9	5 cc. of an emulsion representing one-half growth of agar culture
Dec. 24	50 cc. of emulsion representing washing of growth from 2 agar cultures
Jan. 16	50 cc. emulsion, growth from 8 agar cultures.
Feb. 9	50 cc. emulsion, growth from 2 mass cultures from flasks, surface area $6 \times 2\frac{1}{4}$ inches
Mar. 7	50 cc. as above from 4 mass cultures
Mar. 31	50 cc. as above from 8 mass cultures.
April 19	do.
April 28	do.
May 11	do.
May 21	do.
June 13	do.

HYGIENE OF LIVE STOCK

In the above work four strains of anthrax bacilli were used, known as "0071", "Burt", and "Boener", the first two being highly virulent types and the latter two very much weaker.

On June 25, 1915, 6 litres of blood were drawn from each horse. Since these animals have been bled regularly, 6 litres being taken from each and an injection of virus made in the intervals between bleedings.

In standardizing the serum, that taken from each horse was tested on guinea pigs into which 48 hours later a bouillon subculture of the attenuated strain known as "Davis D" was injected. The results of the serum of the two horses agreed, 5 guinea pigs out of 6 remaining alive with the normal horse serum 5 out of 6 died.

In view of these results the "Davis D" culture was used in the preparation of the spore vaccine to be used simultaneously with the serum.

In the preparation of the spore vaccine the writer recommends using bouillon agar media and, after inoculation with the attenuated culture, incubate the organism at a temperature of 37.5° C. for 4 to 7 days, by which time an abundance of spores will have formed. The growth is then collected in a sterile flask and heated at a temperature of 60° C. for half an hour to destroy the vegetative forms of the organism. A measured quantity of the suspension can then be plated out in the usual manner and the spore count of 1 cc. of the suspension established. A dilution can then be made to the desired amount for inoculation purposes. For cattle and 5 cc. of vaccine containing 1 000 000 spores would constitute a proper dose, while for calves and sheep it has to be correspondingly smaller.

The pathogenicity of spore vaccine should be such that an inoculation of approximately 250 000 spores (0.25 cc. of the standard suspension) kills guinea pigs in from 2 to 5 days while rabbits remain alive.

For immunization purposes by the simultaneous method the serum should be injected first, then the spore vaccine.

In herds where the disease has already made its appearance it is necessary to take the temperatures of all the animals and to subject to the simultaneous vaccination only those that show no rise in temperature. Others should be given the serum-alone treatment in doses varying in accordance with the severity of the symptoms. If there is a considerable number of infections, it is advisable to use the serum-alone for all the animals and in 3 or 4 weeks to revaccinate by the simultaneous method.

The simultaneous method was experimented on cattle and sheep at the experiment station of the Bureau of Animal Industry at Bethesda, Md. with success.

The serum treatment was tested on pigs in a Maryland farm with the result that every affected animal recovered and not a single death from anthrax occurred among those animals that received protective doses of the serum.

The serum and spore vaccine treatment was applied on several farms in Queen Anne County Md. to a total of 399 animals, including horses, mules, cattle, sheep and pigs, and to a total of 125 cattle in Noxubee County Miss. in both of which places the disease had broken out. No deaths

from anthrax occurred after the vaccination, the affected animals were covered from the disease.

For the use of serum in the treatment of anthrax in man it is recommended that from 30 to 40 cc. of serum be injected in three or four different places.

Conclusions:

1) Horses are suitable for the production of highly potent antiserum. Serum of such horses should protect large animals in toto.

2) The use of the serum-alone treatment is indicated in cases in which the infection has already occurred in a herd. Since the serum confers only a passive immunity, it is advisable to revaccinate the herd 3 to 5 weeks by the simultaneous method.

3) The serum possesses great curative value. Depending on the severity of the infection, the curative dose is from 30 to 100 cc., the injection to be repeated if necessary.

4) For the simultaneous treatment a spore vaccine, carefully standardized, is preferable to the ordinary Pasteur vaccine.

5) Spore vaccine should be employed also in preference to the Pasteur vaccines for immunization with vaccine alone. This vaccine has a decided advantage over the Pasteur, because of the possibility of more accurate dosing and because of its better keeping qualities.

6) Experiments with concentrated serum and dry spore vaccine are very promising. This method would greatly simplify the vaccination process and also insure the product against subsequent contamination and deterioration.

313 **Studies on Changes in the Degree of Oxidation of Arsenic in Arsenical Dipping Baths.** (1) — CHAPIN, ROBERT M. in *Bulletin of the U. S. Department of Agriculture*, No. 284, 12 pp. Washington, July, 1913.

For some years past it has been known that in the arsenical dipping baths are extensively employed for eradicating cattle ticks, the sodium arsenite gradually oxidizes to sodium arsenate, which is less poisonous and less efficient against ticks. FULLER of the Bureau of Animal Industry showed that this change is essentially brought about by the growth of microorganisms in the dipping baths, other factors being relatively of little importance. Studies on this subject have been continued during the past two years.

The field experiments of 1913 involved the taking at fortnightly intervals of samples from a number of vats in different sections of the country, and of testing them at the vat, after which they were sealed with wax or paraffin and analyzed at the laboratory. The results were plotted in diagrams.

The laboratory experiments consisted:

1. — In inoculating a mixture of peptonized broth with stock arsenic solutions (arsenite and arsenate) with a portion of used dipping bath from the field. The mixtures were then left at room temperature for six

(1) See also *ib.*, June, 1913, No. 261.

specimens of time, after which they were again analyzed and their final results compared with their initial one.

In testing the efficacy of some antiseptics against the activity of reducing and oxidizing organisms.

The experiments of 1914 were directed toward determining the efficiency and practical applicability of formaldehyde as a preservative against bacteria in dipping baths in the vat.

From the results obtained the following conclusions may be drawn:

1. All used arsenical dipping baths may be expected to contain: *a*) reducing organisms which work slowly, but steadily and *b*) reducing organisms which work very rapidly at times, but irregularly. The reducing organisms exert an appreciable effect only when the baths are used at frequent intervals for dipping large numbers of cattle. The ordinary vat, used once a fortnight, is likely to show only a slowly progressing oxidation of the arsenic and periodical analyses should be made if proper dipping strength is to be maintained.

2. Formaldehyde solution (37 per cent) used in the proportion of 100 to every 1500 gallons (8 $\frac{1}{2}$ fluid ounces to 100 gallons) of liquid dipped into the vat, appears a safe and effective means for reducing oxidation to a low figure. But since there seems to be no evidence that under any conditions oxidation is ever likely to progress so far as to result in a bath injurious to cattle, the question of the use of formaldehyde is purely economic. The writer believes that in most cases it will be better to let some of the arsenic go to waste through oxidation. When 1000 of a gallon of formaldehyde about equals the cost of all the materials used to make 500 gallons of dipping bath, there will probably be little saving either way, while there may be some real profit in its use in saving of labour in preparing the dip and through the reduction of offensive odour from the bath by keeping it under antiseptic conditions.

The Precipitin-Reaction of Pork Infested with *Cysticercus cellulosae*.—

SCUDIZZI, G. C. in *La Clinica Veterinaria*, Year XXXIII, No. 21, pp. 845-850, 1915, November 15, 1915.

During the winter 1914-1915 all the specimens of measy-pork from the municipal abattoirs of Venice were examined by means of the precipitin test to determine if all the diseased pork gives the reaction and whether the reaction is strictly specific for the parasite.

After giving a minute description of the specimens examined and of the procedure followed the writer makes the following conclusions:

1. By means of the precipitin-reaction parasitic antibodies can be detected in the serum of measy pork.

2. These antibodies, however, do not appear to be absolutely specific, 4.5 cases positive results were obtained in treating an albuminous solution of measy pork with the antigen of *Cysticercus cellulosae* and also with antigen of *Echinococcus*. In other cases positive results were obtained in treating an albuminous solution of pork infested with *Echinococcus* with antigen of the cysts of *Echinococcus* and of *Cysticercus cellulosae*.

3) These antibodies were also obtained from 3 cases of moribund, dying degenerated *Cysticercus cellulosae*.

4) In two cases of parasitic infections not caused by *Cysticercus*, antibodies were not found.

345. **The Problem of Horse Sickness in South Africa.** — THEILER, SIR A. (1921). *South African Journal of Science*, Vol. XII, No. 3, pp. 65-72. Cape Town.

The agent responsible for the malady (common in South Africa) known as horse sickness is a micro-organism which, belonging to the class of ultra-visibility, is generally spoken of as a virus. There are two principal diseases, known respectively as the "Dunkop" and "Dikkop". No positive proof has yet been obtained as to how the virus gains access into the body of a susceptible horse but all the evidence points to the agency of winged insects, particularly mosquitoes. Attempts to convey the virus by means of these latter have, however, met with no result, notwithstanding the large number of species used. Possibly the difficulty of keeping mosquitoes alive for a sufficiently long period is partly responsible for the failure recorded.

With the object of discovering the source whence the insect obtains its infection a number of inoculation experiments were made in birds (27 species), various wild mammals, reptiles and Amphibia. In addition to these the blood of domesticated ruminants, horn and legged, and horse sickness rum was used, and even that of a few natives, but all were always negative. The geographical distribution of both the diseases and certain animals would give a clue as to the direction in which the experiment should be undertaken. For instance, it is known that the sickness does not occur in Western Africa from North of Angola to the North East Africa, but is present right through Central and Eastern Africa to the shores of the Red Sea.

From a practical point of view, the question of immunity is of great importance. Horses and mules may recover from either the Dunkop or Dikkop form of the disease but are not as a consequence necessarily immune from fresh attacks. A number of horses were injected with two different viruses, the first, known as the "ordinary virus," being obtained from a horse attacked by the sickness and the second, known as the "Tzaneen virus," from a case of reinfection in a mule considered to be immunised. From these experiments it results that although a horse may not react to a virus at one moment, yet when re-injected with the same virus at a later date, death results. Further, with ordinary virus more horses die of Dunkop than of Dikkop. With the Tzaneen virus the reverse is the case. A certain number, however, entirely failed to react.

The majority of the horses that survived the injections were re-tested for their immunity. Again a certain number of horses failed to react, and it is estimated that the number of horses that will resist all forms of virus and be considered completely immune is 3 to 4 per cent.

Of the horses that reacted to the original injection (both forms) a better immunity was given by ordinary virus, and, as regards the two forms of the malady, a horse that has recovered from the Dikkop form of the

better chance of resisting later infection than one which recovers from the Dunkop form.

Means of cure or prevention.—The use of several of the more familiar chemotropic drugs, e. g. arsenophenylglycin, salvarsan, novoflavin and paraffin dyes, has been unsuccessful. Nor is the use of serum therapy of much value from a curative point of view. Eradication of the disease is impossible as neither the virus reservoir nor virus transmitting insect is known; there consequently remains the protection of individual animals. Stabled animals can be protected against the disease effectively if the stable is insect proof, as, however, horses and mules must be out at any time and frequently during the night, a protection applied to pastures comes into consideration. The use of paraffin oil has been fairly successful. Antiseptics of the tar-derivation group have also been used, particularly as sprays, with varying results. Lately, encouraging results have been obtained by dipping horses and mules at regular intervals in a cattle dip, in which was added 3 gallons of linseed oil and 2 gallons of paraffin oil every 300 horses. Experiments to obtain a better protective substance to be applied to the skin of horses are in progress.

Bush Sickness, Work at the Mamaku Farm, New Zealand. BEAKES, C. J. and AUSTIN, E. L. C. in the *Journal of Agriculture*, Vol. XI, No. 5, pp. 377-384, 4 figs. Wellington, New Zealand, November 20, 1915.

The New Zealand Department of Agriculture founded at Mamaku an experimental farm for the study of the disease called "bush sickness" which attacks cattle and sheep, especially young animals, grazing in the bush. The work done at the farm since 1912 proves that the pastures which cause bush sickness are situated on soils which contain iron principally in a form unavailable under natural conditions, and produce herbage lacking the necessary chemical constituents. These pastures can be much improved by an abundant use of phosphatic top-dressing. Phosphates are given the best results, of these a mixture of basic slag and superphosphate undoubtedly has increased the growth of clovers to a greater extent than the other phosphates. A trial is now being given to a basic phosphate and ground rock phosphate.

The efficiency of syrup of phosphate of iron both in curative and preventive treatment has already been well proved, but its one drawback is that it has to be administered by hand daily over a period of some three or four weeks at a time.

Experiments were therefore begun with cattle licks. After several trials with other mixtures one was finally adopted containing perchloride of iron and salt cemented together with plaster of Paris and a little lime. The stock in time become very fond of the lick. The bricks must not be exposed to the rain which would dissolve out the constituents.

Sufficient evidence is already available to prove that this lick is of great value in maintaining health, but it must not be assumed that it is itself sufficient to enable cattle and sheep to be kept healthy. It is still then that proper manurial treatment of the soil is a most valuable factor combating bush sickness.

Notwithstanding the above means, considerable difficulty is encountered in rearing young animals and further experiments are being conducted at the farm in order to solve the problem.

347. **Berberi and Cottonseed Poisoning in Pigs.** — ROMMEL, GEORGE M. (Husbandry Division, Bureau of Animal Industry) and VEDDER, EDWARD B. (Medical Corps, United States Army) in *Journal of Agricultural Research*, Vol. 1, pp. 45-49, Washington, D. C., December 13, 1915.

Cattle fed for more than 90 to 102 days on a heavy cottonseed meal ration (6 lbs. or more per head daily) become lame and their eyes discharge freely, blindness often resulting. Pigs, also, are peculiarly susceptible to the effects of cottonseed meal, the symptoms of sickness appearing at a late time after 3 weeks of feeding, and deaths frequently occur without warning. The disease in these latter animals manifest two forms, acute and chronic, and among the more pronounced symptoms are diarrhea, a harsh, rough, curly coat; paralysis, and shortness of breath. The conditions revealed on post-mortem examination bear a striking resemblance to those seen in the disease known as berberi in man.

The writers have carried out a series of experiments to determine (a) whether the "wet" or acute form of berberi could be produced in pigs on a diet of polished rice and (b) whether the disease hitherto called "cottonseed poisoning" is not really berberi. The ration consisted of steamed polished rice and tankage (c) 1 or of maize meal and cottonseed meal combined in varying proportions. In all cases the pigs developed the typical symptoms of berberi.

The studies of the writers seem to lead to three general conclusions:

(1) Pigs are susceptible to berberi when fed on vitamine deficient rations, such as rice. Symptoms of a pronounced character sometimes occurred after 8 to 10 days.

(2) It is believed that the so-called cottonseed poisoning of pigs is a deficiency disease, analogous to the disease known as berberi in man, but not indeed identical with it. Acute cottonseed poisoning corresponds to wet berberi, and the chronic form to dry berberi.

(3) The cause of the so-called cottonseed poisoning is probably a deficiency in the ration, causing, among other manifestations, profound changes in the nervous system. The following explanation of this condition is offered: The grain with which the cottonseed meal is most frequently combined is maize. Maize is notoriously deficient as a single feed for animals and must be properly balanced to be fed satisfactorily. When maize meal is fed with cottonseed meal, a combination is made of two feeds both of which are deficient.

The writers are engaged in further studies of this subject to determine more exactly the effects of cottonseed meal when fed in the ration of the pig, and to determine whether methods similar to those used to prevent berberi in man can be practically applied to prevent the so-called cottonseed poisoning of pigs.

Observations on Fowl Cholera.—MAZZUOLI, S. in *La Clinica veterinaria*, 1916, LXXVIII, N° 1, pp. 1-6, Milan, January 16, 1916.

Experiments at the Institute of Hygiene of the Veterinary School at Padua on the serious nature and wide distribution of this disease. From study of the means of and conditions necessary for the occurrence of this disease in practice the writer makes the following observations:

1. The ingestion of virulent blood and slime of fowls that have succumbed to the disease does not result in infection even if the quantity of ingested is considerable and even if the ingestion has been repeated many times.

2. Ingestion of faeces of sick fowls in any stage of the disease in exceptional cases results in the infection of healthy birds.

The propagation of the disease is not effected by ectoparasites (*Psittacus*).

The writer concludes that the diffusion of the disease is correlated with presence in some part of the body, especially the feet, of wounds through which the virus from the faeces or slime gains entrance and reaches the bird. In a similar manner infection may occur through lesions in the mucous membranes.

The results of these observations agree with those obtained by DOERSCHKE (*Centralblatt für Bakteriologie*, Vol. 76, p. 491, 1915) showing that the most frequent channel of infection is not the alimentary canal as commonly supposed.

The Control of Contagious Epithelioma in Chickens by Vaccination.—MACK, ALBERT E. and RECORDS, EDWARD, *Agricultural Experiment Station, The University of Nevada*, Bulletin N° 82, 16 pp, Carson City, Nevada, June 1918.

The etiological identity of roup, avian diphtheria, and contagious epithelioma is a subject of controversy which requires further extended research to settle. Consequently it is uncertain whether the cases dealt with in these experiments were caused by pure contagious epithelioma virus or were due to mixed infection.

The use of a virus prepared by triturating the morbid products collected from the skin and mucous surfaces and attenuated at 55° C. for one week checked the spread of the disease promptly and exercised a favourable influence upon visibly infected birds. Cases thus treated ran a shorter and milder course than those not treated, and the mortality was materially reduced.

Two injections were sufficient in most instances, but severe advanced cases benefited by a third and larger dose.

In five flocks containing 3,062 birds, 1,068 of them thoroughly exposed to 100% or 45-52% of them visibly infected, the spread of the disease after vaccination was negligible. Of the 1,304 visibly infected birds treated, 21.45% died, and 1,095 or 78.55% recovered.

On the whole, the treatment was satisfactory and successful. In five flocks no unfavorable results followed the subcutaneous administration of vaccine, but in two flocks serious toxic and septic processes were apparently caused by it. The crude preparation used is not, therefore, without

danger, and a more refined product must be devised. However, the conclusion appears warranted that in this method we have a fairly simple means for promptly checking outbreaks of contagious epithelioma, or other uncertainly defined diseases, if there be more than one species, producing similar morbid conditions in fowls, and a therapeutic of considerable value. Furthermore, that the prevention and control of a disease or group of diseases may eventually be placed on a sound basis seems certain.

- (29) **The Control of Sex.** MOROSINI, A. in *Nuovi Annali di Agricoltura Siciliana*, Series VI, Part III, pp. 192-196, Palermo, September 1918.

The writer summarises the most likely hypotheses advanced on subject of the determination of sex.

1) *Hypotheses involving purely internal and organic factors.*

- a. *Nature of the sex cells.* (BERTON, MESTORIE, BOUCHET, MAYER.)
- b. *Mutability of the sex cells.* (THURCY, GIACCHI, GERBIS, COSTE, ALBERTI.)
- c. *Preformation of the parent sex in other organs.* (GIBON, MARTEGOTTE, MOROSINI, ORCHANSKY.)
- d. *Influence of the nervous system.* (RAWSON, DORING.)

2) *Hypotheses involving environmental or entirely external factors.*

- a. *Influence of climate, seasons, temperature, etc.* (AXEL-KY, DUSING, SCHUBERT.)
- b. *Influence of nutrition.* (JOURG, NESSHAUM, MACPIS, CALKINS, MOLLARD, TREVAL, KYBER, KNIGHT, DORGER, SCHENK, RUSSO, DUCCESCHI, TALLARICO, ROBINSON.)

3) *Alternative hypotheses involving the influence of various agents.* (CHESZ, ORCHANSKY, RUSGOTT.)

4) *Hereditary hypotheses involving the existence of two species of Chromosomes following Mendel's Law.* (CHESOT, BATESON, SAUNDERS.)

Assuming that the fundamental factor determining sex is strictly metabolic one, the writer, working in the Laboratory of Legal Medicine at the Royal University of Palermo, endeavoured first to determine into what the real nature of the sex cells actually consists, then, extending this to the sex of the matter contained in the cells, he attempted the solution of the other unknown factors more or less directly concerned with the fundamental question.

Following this method he first showed that sexual dimorphism can result from the action of the same factors in all species, and that the crux of the question must be sought in various circumstances which, according to the particular case, act on the metabolism and consequently on the sexual differentiation, circumstances which are always different in the different species and of which part escapes detection.

- (1) Russo crossed normal black rabbits (dominant) with Himalayan recessives, and obtained, contrary to Mendelian expectation, almost all recessives and almost all females in the 1st generation of hybrids.

The nutritional hypothesis taken as a basis of sexual differentiation according to the writer, be understood as the product of the interaction of numerous and varied elements of the most diverse functional value capable of being grouped under the heading of heredity and environment.

The factors which the writer has united in his researches include precisely the most important of those which biologists have applied separately each case. He has succeeded by this method in obtaining for a long series of generations of different pairs of animals, litters exclusively unisexual, all males and then entirely females from the same parents.

This method is now being applied to live stock (sheep, asses and cows) of the Agricultural Institute of Calstelnuovo and the Royal Zootechnical School of Luparello (Palermo).

The Inheritance of Coat Colours in Horses (11). — ANDERSON, W. S. in *Kentucky Agricultural Experiment Station Bulletin* No. 170, pp. 121-145, Lexington, Kentucky, 1913, 34.

In this paper the writer gives tables on the inheritance of coat colours in horses which include 14,055 matings or the colour of 42,105 horses. The data are obtained from STURTEVANT'S tables and the American Bre Horse Register.

In the study of the hereditary connection between the various coat colours in horses, one great difficulty is found in the fact that the distinction between the three colours: black, brown and bay is not sharp. This difficulty is the cause of a number of errors and inaccuracies in the variation of the colour of foals which account for most of the apparent mistakes in the transmission of coat colour by inheritance. Thus from the table drawn up by the writer, the inheritance of all the colours, with the exception of brown, appears clearly. In order to get over this difficulty the writer proposes to register simply mahogany brown as bay, and seal as black. In this way the appearance of brown where bay or black spotted could easily be explained.

Similarly, the question as to whether brown is recessive or dominant to black is rendered so complicated by the confusion of these colours that no longer be raised. There would thus remain only six colours which according to the writer can be arranged in the following order: the three white colours gray, roan and dun, dominant to bay, black and chestnut, bay dominant to black and chestnut and black dominant to chestnut.

There being no records that would indicate the comparative strength between roan and gray, these colours, for the present, are placed at the top of the list as of coordinate strength.

As to the question whether the coat colour is connected with other qualities of horses, there seems to be no evidence in support of this view. The factors which control the transmission of colour appear to be independent of all other qualities.

CATTLE

The laws governing the heredity of colours promise to be of great value as an indication of the method for further research on the laws governing the transmission of the other qualities of horses, and as assistance in putting the breeding of horses upon a more scientific basis.

As regards the colour of the hair, it is finally due, as suggested by KASTLE, to:

1. An oxidizing enzyme of the nature of Tyrosinase.
2. The presence of an oxidizable chromogen as Tyrosin or some similar compound.
3. The extent to which the chromogen is oxidized by the enzyme.

As the oxidizable chromogen is present in the skin and hair, even possibly in albinos, the question is what determines the extent to which the chromogen is oxidized by the enzyme? As the inheritance of colour in horses is transmitted from generation to generation, that which determines the extent to which the chromogen is oxidized must reside in the cells. The name given to it is *factor* or *determiner*.

There are in animal coat colours, two kinds of white, one is dominant and the other recessive. It has been suggested by GORTNER that dominant white is due to the presence of an inhibitory enzyme in the epithelial cells which prevents the action of the oxidase, and that two whites differ by not having the power to produce pigments. The recessive white lacks the chromogen or oxidase, or both. The latter, or albinism, would of necessity be recessive in as much as it lacks the power to produce pigment and is without the means of inhibiting pigment production if the elements for its formation are present.

The writer then discusses the colours of human hair and lastly the subject of breeding horses to colour. The task is easy for the colour, white, recessive to all the others, namely chestnut, and more difficult the less the degree of dominance of the colour desired.

322 **Cow Testing and its Advantages.** — I. COLE, R. D. in *Department of Agriculture and Technical Instruction for Ireland*, Vol. XVI, No. 1, pp. 346, 9 tables, 16 October 1915. — II. Scheme for Encouraging Improvement in the Dairy Cattle of Ireland, *Ibid.*, pp. 154, 156.

1. — The Department of Agriculture and Technical Instruction for Ireland introduced, in 1906, a scheme for establishing a register of dairy cattle, under which the owners of officially selected cows undertook to keep one year records of the milk yield of each animal. At the end of the year all cows with a milk yield of a certain quantity and a certain butter-fat percentage were entered on the register or herd book. Cows from such cows sired by pure bred Shorthorn bulls or by registered Friesian bulls were subsequently inspected and those which came up to a certain standard were selected as eligible for premiums of £10 per annum. In 1912 the qualifications necessary for entry on the register were fixed: annual yield of milk not below 6,000 lbs. with an average butter-fat percentage of at least 3 per cent. Having introduced the system in this way the Department next proceeded to establish cow testing associations. They accordingly have appointed two instructors in cow testing, who will

of farmers and explain the objects and advantages of keeping records, and also the desirability of forming such associations. In order to encourage this work further, provision was made in connection with the scheme for Improvement of Dairy Cattle in Ireland for grants to testing associations which undertook to keep systematic records of the yield and quality of milk. Under this system a number of farmers from the same district join together and form an association with president and secretary, or supervisor. The members undertake to weigh milk from each cow morning and evening on one day each week during milking period and, at the same time, take a small sample for the determination of butter-fat. The weight of the milk is entered by the farmer on a record sheet, which is sent by him to the supervisor together with the several composite samples at the end of the month. The supervisor is responsible for the necessary tests for butter fat, entries and calculations etc. which will enable the farmer to know exactly what is the total yield and money value of the milk produced by each cow in his herd during the month.

When an Association has been formed and the Department are satisfied that suitable arrangements have been made to carry out the work of the association, they supply the association with the necessary record forms and charge, and also for at least one year, contribute at the rate of two-pence per cow, per monthly test, towards the cost of testing for butter fat, while the members contribute another penny per test, and that satisfactory records for at least 100 cows are kept throughout the year, and that members are testing all the cows in their herds.

At the end of the milking period, on application being made, the Department are prepared to inspect all cows whose yields of milk and butter-fat are up to the necessary standard, and those which are of good conformation and of well-defined Shorthorn type are placed on the register of the title.

By means of such a system of cow testing with the gradual elimination of unprofitable animals, it is considered possible to raise the average milk yield of Irish cows by at least 200 gallons per cow, this would mean an extra income to the country of almost £6,000,000 per year.

II.—Provisions of Scheme No. 20 of the Department of Agriculture "Technical Instruction" for Encouraging Improvement in the Dairy Cattle of Ireland".

Under this scheme the members of cow testing associations pay a much smaller proportion of the supervisor's remuneration than is the case in most other countries where milk records are kept. In Denmark the members pay (approximately) three-fourths of the cost of testing the milk, while the Government the other one-fourth, while in Ireland the Department pay two-thirds of this cost and the cow owners one-third.

The system of working cow testing associations in Denmark and some other countries is different from that practised in Ireland, inasmuch as under the Danish system it is usual to appoint a whole-time supervisor — or better, to each association, and this man travels from one farm to another,

visiting each member about once a fortnight. Such a system can be easily recommended provided the herds are large (provisions for association scheme) but it would not be suitable in the case of associations where the herds are small and scattered over a wide area.

323 **The Value of Barley for Cows Fed Alfalfa; Experiments in California.** GORDON, H., WOLF, E. W., and VOORHIES E. C. in *Agricultural Experiment Station, California, Bulletin* 239, pp. 128-145. Berkeley, Cal., 1915.

These experiments were made by the writers in 1913-1914 at the Berkeley Experiment Station, in order to determine the effect produced by the milk yield and the increase in the live weight of milch cows due to the addition of barley to a ration consisting wholly of lucerne. In the first experiment, 2 lots, each of 7 cows, were used; the animals belonged to the following breeds: Jersey (2), Shorthorn (5) and Holstein (7). They were fed for 3 periods of 3 weeks alternately on 1) lucerne (green, and in the form of hay); 2) lucerne + ground barley. The cows received 7 lbs. of green lucerne per head daily, and lucerne hay *ad lib.* The barley was fed in proportion to the amount of milk produced, the ratio being approximately 1 pound of ground barley to every 5 pounds of milk. The average age of the 1st lot of cows was 4²/₅ years, and that of the 2nd 4¹/₅ years, while the average number of months to the next time of calving was respectively 8.4 and 7.9. In order to accustom the cows to the rations they were to receive during the experimental period, a preliminary feeding of 6 days was introduced. The live weight of the animals was determined for 2 consecutive days at the beginning and end of the experiments, and averages for each experiment were calculated. The results of the first experiment are given in Table I.

The increased production due to the addition of barley was thus 10 per cent in the case of milk, and 1.3 per cent in that of butter fat. When on lucerne and barley, the cows ate 42 pounds of barley and 12 pounds less of lucerne hay per head weekly than when on lucerne only. Taking this difference into account, and on the basis of milk selling at 16 cents per gallon and including the value of the gain in weight by the cows at 5 cents per pound, it is seen that a profit of \$4.78 was secured per cow each week as a result of adding barley to the lucerne ration. If on the contrary the price of the butter fat, instead of that of fresh milk, is taken into account, a loss of \$5.62 for the cows during the actual feeding of barley is obtained.

In the 2nd experiment, the writers used two lots of 9 cows belonging to the following breeds: Holstein (10), Shorthorn (5), Jersey (2) and Guernsey (1). The average age of the cows of lot A was 5¹/₂ years and that of lot B, 6 years; the average number of months to the next calving period was 2.7 and 8.1 respectively. This time, the experiment was divided into 2 periods each of 4 weeks duration. The other conditions were the same as those in the first experiment. The results are given in Table II.

The increase in the milk and butter fat production, as well as the gain in live-weight, were not sufficient to pay for the barley fed in addition to the lucerne, whether the calculations be based on the price of the whole

TABLE I. — *Results of Experiment I.*

Experiments	Lots of cows	Food consumed per cow weekly			Production per cow weekly			Average live weight per cow lbs.
		Green Lucerne lbs.	Lucerne hay lbs.	Ground barley lbs.	Milk lbs.	Fat Per cent.	Fat lbs.	
August 1909	A	—	—	—	201.2	—	6.95	1 058
	B	—	—	—	198.0	—	7.30	1 000
August 20	A	210	152	45.1	212.5	3.5	7.40	1 059
	B	210	162	—	162.0	3.8	6.12	1 003
22 September 16.	A	210	140	—	172.9	3.6	6.15	1 070
	B	210	120	30.6	160.8	3.7	6.40	1 117
12-17 October 7.	A	210	140.6	41.4	176.5	3.7	6.62	1 004
	B	210	151.9	—	138.2	3.8	5.34	1 133
Increase								
weight of lucerne hay	A - B	210	141	42	183.3	3.6	6.65	24
weight of lucerne per cent.	A - B	210	153	—	157.0	3.7	5.87	13.5
weight of barley	—	—	12	42	25.7	0.1	6.78	10.5

TABLE II. — *Results of Experiment II.*

Experiments	Lots of cows	Food consumed per cow weekly			Production per cow weekly			Average live weight per cow lbs.
		Green Lucerne lbs.	Lucerne hay lbs.	Ground barley lbs.	Milk lbs.	Fat Per cent.	Fat lbs.	
August 1909	A	—	—	—	157.2	3.64	5.68	1 099
	B	—	—	—	155.0	3.80	5.93	1 159
August 20	A	451	50	40.1	150	3.70	5.53	1 110
	B	565	45	—	138.4	3.74	5.18	1 174
22 September 24.	A	482	152	—	90.8	3.80	3.79	1 132
	B	428	141	40.5	110.7	3.85	4.61	1 206
Increase								
of the periods of the 60 barley	A + B	440	95	40.3	134.9	3.78	5.68	1 161
of the periods of the 60 lucerne	A - B	523	98	—	119.1	3.76	4.48	1 153
weight of barley	—	83	3	40.3	15.8	0.62	0.60	8
100 per cent.	—	—	—	—	16	—	13	—

milk or the butter fat. However, the immediate economic results secured are not the sole criterion by which to judge of the economic desirability of adding barley to a ration of lucerne. On account of the known influence of grain feeding upon the condition of cows and their milk, it may be concluded that the practice of feeding barley to cows is also economically sound, and for this reason, it is recommended by writers.

324 - **Diuresis and Milk Flow.** — STEENBOCK, H. (Assistant Chemist, Agricultural Station of the University of Wisconsin) in *Journal of Agricultural Research*, Vol. V, No. 11, pp. 507-608, Washington, D. C., Dec. 27, 1915.

The writer has experimented to ascertain the effect of well-known diuretics on the milk yield. Proof that these are able to influence milk secretion might lead to the discovery of a means to vary the proportions of individual constituents of the milk.

Two goats in full milk were used as the experimental animals and were fed the following rations: Goat 1, weighing 90 lb., was fed daily a ration consisting of 2 lbs. of alfalfa, 1 lb. of fine grass hay (*Poa trivialis*), 60 gm. of air-dried casein, 1 lb. of fresh sugar beets, 1 lb. of carrots and 2 gms of common salt. This provided sufficient energy and a satisfactory nutritive ratio to serve excellently for milk production.

Goat 2, weighing 80 lb., was fed from 1.5 to 2 lb. of oats, 0.5 to 0.75 lb. of fine alfalfa, 1 gm. of common salt daily, though the latter was often refused. The specific diuretics were sodium acetate, theocin, and sodium chloride. Neither of the first two substances administered in reasonable doses provoke marked diuresis, the effects of urea and sodium are described in the summary of conclusions. Data obtained during period of low secretion or of unusual restlessness on the part of the animal were discarded.

The conclusions are summarised as follows:

- 1) Urea administered in a diuretic dose is able to decrease temporarily the flow of milk. Upon repeated administration the increased intake of water which follows the impoverishment of the tissues with respect to water content balances the draft for water imposed by the diuretic and milk secretion comes back to normal.
- 2) Sodium chloride with its diuretic action as well as its laxative effect is unable to depress milk secretion under normal conditions, as it simultaneously evokes an excessive thirst, which increases the water intake.
- 3) With the decreased flow of milk caused by a diuretic the percentage of solids is increased. Fat is here the principal variable.
- 4) The mammary gland shows no tendency to absorb and get subsequently in its secretion additional urea absorbed by the diuretic.
- 5) It is difficult to interpret the results sometimes obtained with alfalfa hay as due to diuresis alone if urea diuresis can be taken as a type.

325 - **Seventeen Years Selection of a Character Showing Sex-Linked Mendelian Inheritance.** — PENNIE, RAYMOND (Biological Laboratory of the Maine Agricultural Experiment Station) in *The American Naturalist* Vol. XLIX, No. 586, pp. 1-12, 2 tables, 1 fig. Lancaster, Pa., October, 1915.

In 1898 there was begun at the Maine Agricultural Experiment Station an experiment in breeding Barred Plymouth Rock fowls having 3

and the improvement by selection of the character "winter egg production."

The experiment has fallen into 3 divisions or periods, viz:

Period from 1868 to 1907.—This may be called the period of *mass selection*. The plan followed here is the same as would be used in the building up of a first class dairy herd. Individual records of performances are kept. The large producers are mated with the sons of large producers in the hope of obtaining a race of improved layers. A certain minimum performance is required before a bird is "registered." There is no *test of the progeny* in regular matings with respect to their laying ability.

Period from 1908-1912.—In this second period the principle of *progeny testing* was introduced into the scheme of breeding. Further, selection was carried on for low production as well as for high.

Period from 1912 to Date.—During this period all selection for low production was dropped.

The results of the 17 year selection period are set forth in Table I. The effect of individuals involved amounted to nearly 5000.

TABLE I.—*Mean Winter Production per Bird of the Barred Plymouth Rock Flocks from 1869 to 1915.*

Laying Year	Mean Winter Production of All Birds	No. of Birds Making Winter Records	Mean Winter Production of All Birds Selected for <i>High</i> Production	Mean Winter Production of All Birds Selected for <i>Low</i> Production
1869.....	41.93 eggs	70	—	—
1891.....	37.88	85	—	—
1892.....	45.23	48	—	—
1893.....	26.01	147	—	—
1894.....	26.55	254	—	—
1895.....	35.04	515	—	—
1896.....	40.65	635	—	—
1897.....	22.44	653	—	—
1908.....	19.93	789	—	—
1909.....	26.69	359	54.16	22.06
1910.....	31.76	247	47.57	25.05
1911 [*]	39.49	264	50.58	17.00
1912.....	35.03	242	57.42	16.43
1913.....	43.01	182	52.61	—
1914.....	52.26	192	52.20	—
1915 [*]	45.89	179	45.89	—
Totals and Means.....	35.05 eggs	4842	51.49	20.14

* The decline in these 2 years was due to unfavourable environmental influences, for instance, in 1915 an inexperienced man was in charge of the incubation and rearing.

Broadly speaking the experiment has shown that mass selection for high production was not effective while selection which was based upon the performance of the progeny *was* extremely and quickly effective. The explanation of these differences any interpretation which has been given for the explanation of the results on environmental action may be definitely set aside. To the writer, the essential key-note to the explanation of the results of this long experiment is found in the fact that *phenotypic* variation of the character fecundity, in fowls, markedly transcends in degree, *genotypic variation*. It is impossible in the great majority of cases to determine with precision what is a hen's genetic constitution with regard to fecundity from an examination of her egg record alone.

Thus the reason why no effect was produced during the first seven years of selection and a marked effect during the last seven was because the typically high producers were *uniformly* selected during the latter period, not so selected in the former. Mass selection on the basis of performance (phenotypic appearance) is in its essential nature a blind and haphazard process just so long as the correlation between the gametic and phenotypic conditions of the character is not perfect. And it is an outstanding fact of the Mendelian investigations of the last 15 years that the gametic-phenotypic relation is very rarely, if ever, perfect.

It appears on this view that selection for high egg production in a fowl is effective when it is real. That is, if one selects *genetically* high producers by means of the trap-nest *plus* the progeny test a high producing strain is fixed very rapidly. If on the other hand high layers are selected merely by the trap-nest record alone, selection is not really made of genetically high producers except in a portion of the cases.

In discussing the bearing of the results of the experiment upon the general problem of the effectiveness of selection in modifying germinal determiners, the writer denies that there is any evidence whatsoever for assuming that through the process of selection the hereditary determiners of fecundity either have been or can be changed. All that selection has done is to change the constitution of the *population* in respect of fecundity genotypes.

(26) **Squab Raising in the United States.** -- LEE, ALFRED B. (Animal Husbandry, Poultry Investigations, Animal Husbandry Division) in *U. S. Department of Agriculture, Poultry Production*, No. 681, 10 pp., 6 figs., Washington, September 1915.

A list of questions on pigeon raising was sent by the United States Bureau of Animal Industry to pigeon breeders throughout the United States and, among others, replies were received from 22 large breeders who kept from 300 to 2,200 pigeons and produced squabs for market. A large number of replies were received from breeders who kept less than 300 pigeons. Their answers in general agreed with those from the large pigeon breeders although they were more varied.

From the above enquiries and from data supplied by the writer it appears that pigeons are kept in all parts of the United States, but most of the large squab-producing plants are to be found near the large cities of the North eastern States and on the Pacific coast. Many pigeons are kept as a side issue on general farms in the Middle West and South. Prof.

breeds producing large squabs are mostly kept confined in pens, while smaller pigeons which are less prolific and produce smaller squabs of a lower quality are kept on the general farms and are usually allowed their freedom.

Most of the large successful pigeon farms make a business of selling breeding stock and are not devoted primarily to the production of squabs for market. The large squab producers raise almost exclusively pigeons of the Homer and Carneaux varieties, and on a smaller scale some Dragon, Rock Pouter or Hen, and White King. All of them except one keep their birds confined. The birds are mated at the age of 5 to 7 months, the average being 5.7 months.

Wheat, maize, kafir corn, Canada peas, millet and hemp were the grains most commonly fed, while peanuts, grass seed, oats, buckwheat, sunflower seed and cowpeas are also used. About one half of the breeders reported feeding some kind of green food including a wide range of such material. Rock salt was used by one-half of the breeders, loose table salt by one-third, and table salt in hard lumps by the rest. About 16 per cent used an extra feed such as millet or hemp during the moulting period, while 4 per cent who did not use any special feed for assisting the moult supplied a good grain in their regular rations. One third used hoppers in feeding the young.

About one-half supplied tobacco stems as the entire, or for part of the bedding material, and hay and straw were commonly used while others used cabbages, pea vines and alfalfa stems. One-half reported freedom from diseases and about one-fourth gave canker as a common cause of sickness.

The diseases most commonly reported by small breeders were canker, "cough" and roup. The principal method of treatment was prevention: keeping everything clean, using disinfectants and killing sick or diseased birds. The remedies used were kerosene oil, permanganate of potash, copper sulphate, carbolic acid, quassia chips, Ipson salts, Venetian tincture of gentian, or a tonic in the drinking water. Dry sulphur and diluted peroxide of hydrogen were used for treating canker, and kerosene for roup.

All the large breeders sold squabs for market while about one half of the small breeders. Of the small breeders fifty five per cent sold squabs for market only, 33 per cent for market and as breeders, and 12 per cent as breeders only.

Large breeders marketed their squabs at four weeks, except from two farms where they sold them at four and one-half weeks. Small breeders marketed from three to six weeks, the average being 4.2 weeks. The number of squabs marketed from each pair of breeders varied in the small farms from 5 to 22 and averaged 13.8 and the weight per dozen squabs varied from 4 to 18 pounds, while the large breeders marketed 10 to 20 squabs from each pair of pigeons and averaged 13.1, and the weight of their squabs varied from 6 to 11 pounds per dozen and averaged 9 pounds. The average price for the year per dozen squabs varied from \$ 2 to \$ 4.62 and aver-

aged \$ 3.43 for the large breeders while for the small ones the figures \$ 0.60, \$ 6, and \$ 3.01 respectively. The former made an average profit from each pair of breeders which varied from 32 cents to \$ 1.32, aged \$ 1.52, while the profit of the small farms was between 20 cents and \$ 7.50 and averaged \$ 2.20, and the profit from breeders who bred largely for breeding purposes varied from \$ 10 to \$ 20 per pair.

The feed cost for large breeders was from 95 cents to \$ 2.10 per pair of breeders and averaged \$ 1.32; for small breeders it varied from 40 cents to \$ 4 and also averaged \$ 1.32.

An average yearly profit of \$ 1.50 per pair of breeders is a good one for successful plants producing only squabs for market. The price for squabs, especially in large cities, is gradually increasing. The supply, however, appears to keep pace with the demand, judging from the low price.

27. **Orientation of the Mature Silkworm in the Act of Spinning.** *its Coccinelle*, Vol. 1, p. 66, in *Les moules de Soie*, Year II, No 25, pp. 600-601, Rome, Dec. 1913.

In 1914, experiments were made at the Royal Experimental Station of Padua to test the conclusions of MM. Mozziconacci and Koller. For this purpose Russian breeds were chosen as being better adapted on account of their rather elongated cocoons. According to these writers a vertical position of the chrysalid in the cocoon is injurious and should be avoided. In this position the last abdominal segment of the insect would be flattened and completely deformed by the pressure, thus interfering with the copulation of the moths and the production of eggs, which would lack fecundity.

The following results were obtained :

1st Lot. — Breed "*Orange de Tarch*". Cocoons of very dark orange yellow, rather elongated, with one end very pointed.

2nd Lot. — Breed "*Orange de Kabketa*". Cocoons generally of a very pale yellow, irregular oblong shape, pointed at one end.

3rd Lot. — Breed "*Vert de Tarch*". Cocoons of a more or less dark green, elongated, pointed at one end.

It was observed that on the bunches of twigs the cocoons of all the lots had always the pointed end turned downwards. Fifty cocoons of each type were opened and it was found that in all cases the head of the chrysalis corresponded to the blunt and rounded end of the cocoon which pointed upwards.

It was therefore supposed that the constant position of the chrysalis was due to the particular shape of the cocoon and that it was desirable to repeat the experiment with two breeds of different shape viz : the white and green breeds of Marhellan. In the former the shape of the cocoons approaches that of the Japanese breeds, in the second that of the Chinese. It was again it was shown that the head of the chrysalid naturally corresponded to the upper part of the cocoon. After the escape of the moths from the cocoons an abundance of fertile eggs was obtained.

The results therefore do not support the hypothesis of MM. Mozziconi and KATÔ; besides, this latter had been contradicted by M. VERNON in 1904.

Phototaxy in Silkworms. — AEGUA, C. in *Informazioni scientifiche*, Year IV, No 1, January 10, 1910.

Phototaxy is the movement of animals and plants in response to light. It is distinguished from *phototropism* in that the former term implies the movement of the entire individual whilst the latter is applied to movements of parts of the individual.

These experiments were particularly designed to determine if the response of the newly born larvae accounts for the increased response at this stage.

The experiments were made 1) on newly-born larvae deprived of food; 2) on larvae of various ages allowed to feed; 3) on moths.

The results obtained are as follows:

Newly born larvae show active positive phototaxy and are only slightly influenced by the intensity of illumination and not at all by quality of the light.

This response appears to be related to the vigour of the larvae. It diminishes subsequently and disappears at the end of the first stage. In subsequent stages there is a vegetative phototaxy, less vigorous however than that shown at birth, but similar to it in not being affected by colour of the light rays. The moths show no phototaxy at all.

The writer proposes in subsequent researches to study positive phototaxy in various breeds, and to ascertain if it is possible to determine the response of the newly born larvae with a view to obtaining practical means of control.

The Hydrobiological Station at Davos. — FRIEDMANN, J. W. in *Schweizerische Anzeiger*, Year 23, No 12, pp. 131-133, Pfäfersen-Zürich, December 1915.

On October 10, 1915, the first Swiss hydrobiological Station was inaugurated at Davos. The Station was founded by the exertions of the Inspector of Fisheries of the district of Davos, with the financial support of the authorities of the district, and under the direction of the "Kurverein" of the health resort. It will serve provisionally as a laboratory for the two zoologists who for the past year have been occupied in making a botanical and zoological survey of the lake of Davos. The Station, however, is provided with all the necessary apparatus for carrying out the most difficult zoological and piscicultural research. With its two laboratories, and its position close to the breeding ponds and lake, the new institution offers many advantages for a survey of the Alpine lake fauna and flora. Sufficient funds have now been obtained for the formation of a similar Station on the shore of Lake Lucerne.

Fish Culture as a Means of Using Alkaline Land in Hungary. — RUDASSY, M., in

Mezőgazdasági Közlemények, Vár V, Part. 5, pp. 131-138, Budapest, December 1, 1915.

Mezőgazdasági (Pisciculture), Year XVI, No 23, pp. 230-243, Budapest, December 1, 1915.

The immense tracts of alkaline land which form part of the great Hungarian Plain (Alföld) can be improved and reclaimed by means of irrigation,

as has been proved in convincing fashion by the numerous experiments carried out on alkaline meadows and pastures at Bekescsaba by the Experiment Station of Magyaróvár. With regard to these results (1), many writers have drawn attention to the construction of fish ponds as a useful method of using very alkaline land useless for cultivation.

As early as last century it was observed in fish breeding under such conditions that the waters of alkaline soils are very favourable to the breeding of fish. In fact, the water of lake Balaton, the most important lake of Hungary as regards fish-culture, is alkaline. But Lake Pálos is more remarkable in this respect. The writer tabulates the results of 7 years working (1890-1905), from which data it is seen that the average yield of Lake Pálos per acre (it has an area of 1003 acres) varied between 170 $\frac{1}{2}$ and 161 lbs. In view of this success, and the great importance which has been given to fish-culture in Hungary during the last 20 years, construction of artificial ponds has been begun on alkaline land. Fish-culture is better than irrigation for the improvement and utilisation of alkaline land. The excellent results obtained are summarised as follows:

- 1) In ponds with alkaline water, the production of plankton is normal.
- 2) Fish-culture requires a smaller water supply than irrigation; the latter has to be carried out in relatively short periods of time; if the water is insufficient the success of the crop is doubtful. Water is needed at the beginning of spring, when the ponds that have been dried in the winter require filling, this is generally done between February and May, at which season the river floods afford a plentiful supply. The loss of water in these ponds is very small, for the alkaline soil hinders infiltration; the supply is therefore only diminished by evaporation.
- 3) In the matter of manuring, fish-culture is also less exacting than irrigation. Owing to the part played by the water, it is easier to manure the bottom of the ponds than to manure irrigated alkaline soil. Further, the mud left by the spring floods is an excellent fertiliser, while the mud left, when afterwards turned into the ponds, does no harm to the fish. In addition, the cattle that are periodically watered at the ponds, the droppings of aquatic birds, the heavy showers washing the adjacent cultivated land, artificial feeding etc., furnish the ponds with fertilising substances all tending to increase production.
- 4) In addition to the advantages to be derived from the presence of fish ponds on arid land, another advantage of pisciculture lies in the leaching action of large sheets of water. Very alkaline soils that are systematically covered with water are changed and improved in the course of some years, so as to become suitable for any agricultural use.

The writer gives characteristic data relating to the 5 chief fish-breeding establishments on alkaline land; these have been exploited for some years. The areas of these 5 ponds are respectively: 1044 - 1050 - 262 - 884 and they supply the market annually with 176,000 - 220,000 - 50,000 - 70,000 - 100,000 lbs.

(1) See *B.* January 1913, No 15.

1915). Mention is also made of the working of 6 ponds, each of about $\frac{1}{2}$ acres (on the Törökka estate). These were constructed on patches of saline soil, in order to make them suitable for cultivation. In the course of 15 years, the removal of the alkaline substances by the water has so greatly improved the soil, as to allow of the following crops being grown upon it: wheat with a yield of over 22 cwt. per acre), maize for forage and sugar beets (with a yield of 403 cwt. per acre).

In the strength of these results, the first attempts towards the exploitation on a large scale of the "Pusztá Hortobágy" (the largest steppe of the great Hungarian Plain (1) were made. Of the 4260 acres of alkaline land served by the State for irrigation trials, 2840 acres have been set apart for seedbedding Stations. The water is brought to these ponds by a conduit 17 miles long. The writer considers that these Stations should carry out a number of experiments on questions relating to the improvement of alkaline soils, as these problems are of great practical importance to the agriculturists of the arid regions. Thus he recommends: manurial experiments; chemical fertilisers; experiments in ploughing and harrowing the bottom of the ponds, in order to accelerate the decomposition of nutritive substances, and the removal, by washing, of injurious salts, etc.

FARM ENGINEERING.

Implements and Machinery at the Smithfield (London) Show, December 1915.

The Implement and Machinery Review, Vol. 41, No. 489, pp. 1041-1075. London, January 1, 1916.

This account contains a brief description with some illustrations of the most noteworthy exhibits seen at the 117th show of the Smithfield Club which was held in London from the 6th to the 19th of December 1915.

Motor ploughs, agricultural motors, steam and petrol lorries, steam tractors and milking machines were the classes of machinery which received the most attention from the public.

During the week, well attended meetings of the Smithfield Club, Royal Agricultural Society of England, National Traction Engine Owner's and Users Association, etc. were held.

The following are some of the firms represented and a few of their most important exhibits.

HORNSEY & SONS: a new mower; and a 10½ HP. oil engine which can either refined petroleum or almost any kind of crude gas or residual fuel.

JOHN FOWLER & Co.: a 12 HP. compound steam ploughing cable tractor; a special deep anti-balance plough which is convertible to cut either two furrows 12 in. wide and 8 in. deep, or three furrows 16 in. wide and 6 in. deep. It is also provided with special revolving disc skimmers on

(1) See *B. May* 1913, N° 411.

(Ed.).

roller bearings to cut and turn under all surface growth; Fosters, a self-propelled motor plough with the latest improvements. It has proved itself capable of all general farm work and especially for work in rubber vineyards, rubber and other plantations.

R. GARRETT & SONS: a superheated steam motor wagon and a 25-horse-pound steam tractor. By the use of superheated steam a 25 to 30 per cent saving of fuel and water is effected, while the vehicle can travel an unusually long distance without having to take up fuel and water.

CORBETT, WILLIAMS & CO.: a very simple 3 $\frac{1}{2}$ HP. oil engine motor, no heed need be paid after starting, except for oiling once or twice during a day's work.

ROBEY & CO. who have built 35,000 engines since 1852: a 5-ton 10-horse-pound steam motor wagon with a number of recent improvements.

AVELING & PORTER: a splendidly built compound ploughing engine and a 3-ton lorry for running at 12 miles an hour.

FODENS, LTD.: a 3-ton compound steam wagon on rubber tyres, in which the horizontal multitubular boiler is fed by a novel friction pump, which drives speak very highly. The running costs of the wagon are remarkably low.

BRISTOL WAGON AND CARRIAGE WORKS CO.: Victoria petrol engine, simple construction, specially suitable to withstand hard work under varying conditions of farm usage.

MARSHALL, SONS & CO.: Oil engines, 6, 16 and 25 HP. They are completely adapted to any commercial quality of paraffin, or oil fuel residue and crude oils.

CLAYTON & SHUTTLEWORTH: 5-ton steam wagon and a 3 to 4-ton petrol wagon with a 45 HP. vertical engine which runs at a 1000 revolutions per minute. Four speeds forward and one reverse are provided for.

MANN'S PATENT STEAM CART AND WAGON CO.: a light steam agricultural tractor which is equally efficient for ploughing, harvesting, driving a thrasher in combination with a straw elevator or chaff cutter besides being capable of driving any other farm machinery and hauling loads along a road.

WM. ALLEN & SONS, LTD.: a 3 to 4-ton steam wagon, in which the compound engine may in case of necessity be instantly converted into a double-pressure engine. It can carry water for a 40 miles run and coal for 70 miles.

BLACKSTONE & CO.: an engine capable of working on all kinds of crude oils as well as petroleum residue and developing a maximum amount of power with a minimum of cylinder volume. The same firm exhibits a swath turner in which the tines are individually free to follow the surface of the ground and thus the machine works equally well on the steep ridge and furrow as on flat land, without any strain on the mechanism.

W. FOSTER & CO.: a 7 HP. single-cylinder traction engine equipped for a working pressure of 150 lbs. and especially suitable where simplicity is required.

RUSTON, PROCTOR & CO.: a 10 HP. "convertible" internal combustion engine which, with a slight alteration, may be readily converted to run upon benzol, petrol, paraffin and similar fuels or producer or town gas.

great interest was raised by the "Ruston" safety canvas self-feeder for threshing machines (See fig. 1) for the addition of this apparatus to any machine reduces the number of attendants required. It consists of a light canvas bag fixed at the drum mouth, affording complete protection to the attendant and rendering the scattering of the grain impossible. The grain is carried forward on an endless canvas driven by a pulley on the drum shaft.

Wheat sheaves cannot enter the drum owing to the presence of a set of steel prongs which separate the straw.

THE ENGINEERING CO. : simple and reliable motors which start on petrol and then use paraffin and are, therefore, very economical to run.

TRAFALGAR LTD. : light agricultural 10 H.P. tractor, of the semi-Diesel

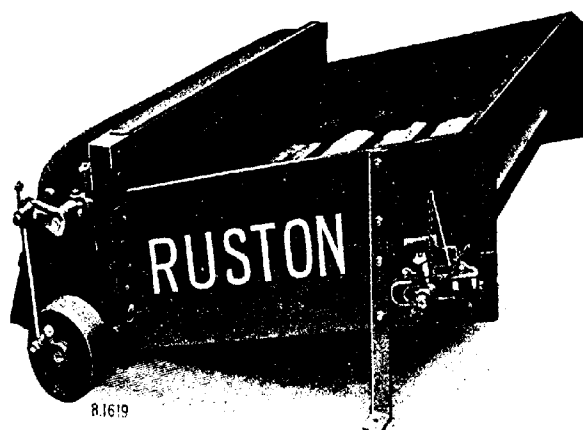


Fig. 1. — "Ruston" safety canvas self-feeder for threshing machines.

is designed to haul and operate any farm implement with only one man in guidance, who is able to steer the tractor by means of reins whilst seated on the plough, mower or other machine to which it may be attached.

DUNKORT ENGINE WORKS : "Farmer's Special," general purpose, surprisingly low-priced, economical and thoroughly serviceable farm engines, of run on petrol only.

RANSOMES, SIMS & JEFFERIES : a heavy four furrow tractor plough for dry land. The steerage of the land and front furrow wheel is operated by a single lever, and the hind furrow wheel is also operated by a lever.

R. E. GLANVILLE : Syracuse reversible riding one way plough (fig. 2), which any boy or girl can manage. It possesses two bodies mounted on the beams, one turning the furrow to the right and the other to the left.

The plough is raised by a foot trip or hand latch on the lever which relieves the labour of raising the plough to the team, and leaves the driver to manage the draught animals while turning. After having turned the other plough is turned, the whipple-trees slide automatically along the line at the end of the long devis so that the implement follows the line of the furrow. The same firm exhibited the "Eureka" potato planter which in one operation, distributes the manure, drops the potato and covers the furrow.

SAUNDERSON AND MILLS: "Universal" tractors for all the work of the farm usually performed by horses. — The 20 HP. model G will pull 10 tons on a good road at 5 miles an hour consuming about 1 gallon of fuel.

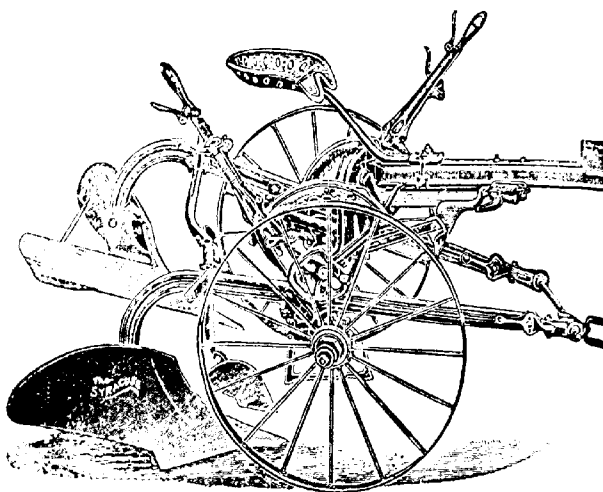


Fig. 2. — "Syracuse" Reversible Riding One Way Plough.

20 ton-miles. Under average conditions it will draw a 3 or 4 ft. plough 6 in. deep up to three quarters of an acre per hour on three gallons of fuel. Petrol, gasoline, benzine alcohol or common petroleum may be employed.

WYLES MOTOR PLOUGH CO.: an 11 HP. double furrow plough which can work to a depth of 12 in. and to a maximum width of 14 in.

MARTIN'S CULTIVATOR CO.: a two furrow motor plough which in 10 minutes can be converted into a farm tractor. It is propelled by two endless track creepers, each being adjusted independently, so that one runs in the furrow and the other on the land. At the speed of three miles per hour

plough three acres a day with a petrol consumption of about two gallons per acre.

COLLINGS: a compound superheated steam tractor and a new four-wheel tractor fitted with a special automatic lifting gear by which the tractor is utilised to lift the plough at the head lands. The work may be regulated when the plough is in motion. This implement may be used independently or as one unit of Collings' combined plough harrow, roller and seed drill for direct traction, to the whole of which one man can easily attend.

N. BENTALL & Co.: "Pioneer" petrol engine and several combinations for crushing, grinding and kibbling fitted with springs to allow substances passing through without damaging the plates.

ROTHSCHILD TRACTOR CO.: a farm tractor which is said to do the work of strong horses; with a three furrow plough it will turn over 7 acres per acre at a cost of 14s., it is serviceable also for cultivating harvesting and general machinery.

SHAW AND SONS: The "Sandusky" American petrol farm tractor, a well constructed, powerful, well finished 40-45 HP. machine for ploughing, harrowing and hauling on roads.

THE AGRICULTURAL MOTORS LTD.: Ivel agricultural tractor, with the latest improvements, among which a system of forced lubrication to all the moving parts; it is of 24 HP. and will haul a 2 or 3-furrow plough two or three mowers etc., or drive any other farm machinery at a remarkably working cost.

INTERNATIONAL HARVESTER CO. OF GREAT BRITAIN: "I. H. C." and "Mogul" stationary and portable engines and "Mogul" oil tractors together with ploughs, one of which was provided with an arrangement whereby pulling a cord automatically lifts the plough bodies. The whole is thus controlled by one man.

C. BURRELL & SONS: a fine steam tractor in which each hind wheel is operated separately, so that there is no strain through the axle.

W. WEEKS & SONS: "Simpler" agricultural 22 1/2 HP. petrol tractor, capable to 2, 4 or 6 miles per hour as well as reverse, and it is serviceable for ploughing or hauling other tilling or harvesting machines or other machinery. It is only 4 ft. wide and can thus be used between two rows in plantations.

W. DALL & SONS: "Criterion" ploughs and farm lorries.

BARFORD & PERKINS: a motor roller with "Cambridge" pattern wheels which travels at speeds from 2 to 4 miles an hour on any land. It is in widths of 5 ft. and 6 ft. but trailing rollers may be attached to give a line width of 10 ft. The weights of the rollers may be increased by filling them with water.

KEARSLEY & Co.: several mowers among which one with two speeds for mowing crops.

A. & W. POLLOCK: "Perfect" potato digger wherein the digging is done in a vertical position when working and closely imitate the action

of hand labour. The "throw" of the forks can be varied to suit all kinds of soil and the share, prongs, wheels, pole etc. are also adjustable.

JOHN WALLACE & SONS: Champion potato digger fitted with adjustable grips or forks which can be set at almost any angle to suit all kinds of soil and which eliminate any liability to damage large tubers.

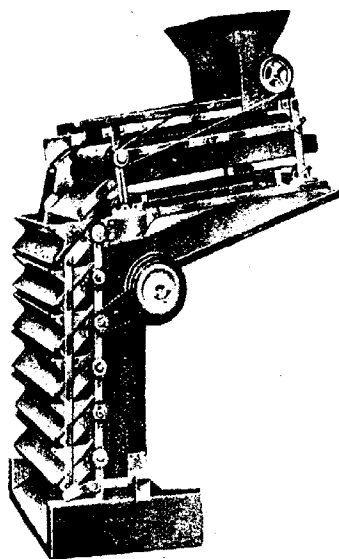


Fig. 4. — "Challenge" Seed Dresser.

WM. FENEMORE: hay loader and hay holder, which save a good deal of time and labour. The hay loader works equally well on ridge and furrow as on level land and it will take up hay as left by the horse or sheep. Any farm vehicle can be used with it and it requires only one man to attach to it.

MUGLESTON IRON WORKS CO.: Mugleston's hay sweep, collects the hay left by the hay maker, swath turner or hay rake and takes it to the stacking elevators without needing carts or wagons. It requires only two men and a lad. It clears a width of 14 ft. and equally well on level or uneven ground. For travelling along roads it can be turned into a compact position reducing the width of the machine to 7 ft.

W. & J. OGLE & SON: a new elevator for building stacks of hay or straw. It can be fixed for work in 15 minutes by a man and a boy and will deliver a horse cart load of hay on the top of the stack within five minutes.

WOLSELEY-HARRIS: a new implement: the "stiff tooth cultivator" with spring trips to prevent breakage when the teeth meet with obstruction, the teeth returning to their normal position when the obstruction is removed.

W. M. DOSSOR: the "Challenge," quite a new departure in seed dressing for clover and small seeds. The work is done by a series of overlapping belts with covers and hoppers which check and redistribute the seed in each section. Each sieve is capable of two motions, jumping or vibrating, and is brushed clean about ten times a minute by its automatic brush.

J. A. PEMBERTON: hog motor and feeder. This machine compels pigs to feed their own grain as they eat. It is a metal cylinder with a hopper on top which holds 4 $\frac{1}{2}$ bushels of grain. The cylinder is rotated by the pig using its snout, pressing it against wooden projections attached to the cylinder and resting on a tray. The ground feed is distributed evenly, insuring each animal an equal amount of food. It is claimed that this implement saves 25 per cent of the grain fed.

J. S. MILLAR: "Superior" churn in which the body of the churn is earthenware which cannot absorb any injurious matter and can be washed and dried very quickly.

Other churns were shown by T. BRADFORD & Co. and by WAIDE & Sons.

Milk separators were exhibited by the WOLSELEY S. S. MACHINE CO., the DAIRY SUPPLY CO., G. LLEWELLYN & SON, the ALEXANDRA SEPARATOR CO., J. S. MILLAR & Co., POND & SON, PERFECT DAIRY MACHINES CO., and the MELOTTE SEPARATOR CO.

The milking machines on view were: the "Vacuar" constructed by the VACUAR MILKING MACHINE CO., A. R. LESTER & Co.'s milking plant and the "Amanco" of the ASSOCIATED MANUFACTURERS' Co. which will milk seven to nine cows per hour, and one man can thereby milk from twenty to twenty five cows per hour.

2. Review of Patents.

Tillage machines and implements.

164 761.	Harrow.
165 247.	Do.
165 531.	Subsoiler and packer for earth.
165 716.	Harrow tooth.

France	475 068. Portable hand plough.
	478 421. Rotary tilling machine.
Sweden	39 728. Hand rake.
	39 431. Rotary tilling machine.
Switzerland	71 561. Implement for making holes in the ground for seed.
United Kingdom	19 212. Apparatus for raising agricultural machines by the draught chain.
	13 519. Hand implement for weeding and thinning plants.
	16 555. Device for vertically adjusting the tool frame relative to the wheels in motor ploughs and cultivators.
United States	13 017. — 1 160 686 — 1 163 143. Gang ploughs.
	13 018. Means for operating gang-ploughs.
	1 160 743. Wheeled plough.
	1 161 111. — 1 161 674 — 1 161 964 — 1 162 068 — 1 162 541. Cultivators.
	1 161 143. Rotary plough.
	1 161 213. Beet plough.
	1 161 241. — 1 161 825 — 1 161 919 — 1 163 401. Ploughs.
	1 161 534. Power operated plough.
	1 162 013. Harrow.
	1 162 077. Cultivator or other vehicle having manually controlled steering wheels.
	1 162 112. Disk-harrow.
	1 162 487. Deep tilling gang plough.
	1 162 842. Subsoiler attachment.
	1 162 902. Roller cultivator.
	1 163 249. Cotton chopper.
	1 163 586. Weeder attachment for cultivators.
	1 163 895. Motor plough.
	1 164 147. Plough attachment.
	1 164 398. Traction plough.
	1 164 590. Gang plough hitch.
	1 164 844. Wheeled cultivator.

Fertilizer distributors.

United Kingdom	19 701. Manure and seed distributing attachment to a disk harrow.
United States	1 160 688. Attachment for manure spreaders.
	1 161 371. — 1 162 093 — 1 164 570. Fertilizer distributor.
	1 163 013. Straw spreader.

Drills and sowing machines.

Sweden	39 439. Device for potato setting machine.
Switzerland	71 561. Implement for making holes in the ground for seeds or plants.
United States	1 160 887 — 1 161 500. Potato planters.
	1 161 218. — 1 162 526. Corn planters.
	1 164 303. Corn planter marker.

Reapers, mowers and other harvesting machines.

- 165 143. Harvester.
- 165 191. Shocker.
- 165 665. Hay dumping rack.
- 482. Mowing machine for water plants.
- 18 422. Improved fingers for mowing machines.
- 18 957. Lawn mower.
- 19 268. Flax pulling machine.
- 1 160 696. Grain harvesting machine.
- 1 160 759. Kafir corn header.
- 1 160 777. Corn husking and harvesting machine.
- 1 161 252. Ensilage harvester.
- 1 161 758. Grain elevator.
- 1 162 869 — 1 164 366. Harvesters.
- 1 162 981. Corn shock harvester.
- 1 163 237. Attachment for harvesters.
- 1 164 133. Self-dumping hay rake.

Machines for lifting root crops.

- 164 917. Harvester for beets.
- 39 378. Implement for cleaning and separating root crops.
- 1 163 348. Potato digger.

Threshing and winnowing machines.

- 165 169. Grain separator.
- 39 358 — 39 602. Winnowing machine.
- 1 163 513. Threshing machine.

Machines and implements for the preparation and storage of grain, fodder, etc.

- 164 805. Grain grinder.
- 148 927. Straw baling press.
- 39 378. Implement for cleaning and sorting root crops.
- 19 133. Machine for pearling or polishing rice and other grain.
- 1 161 211. Potato screening and sorting machine.
- 1 162 817. Portable grain elevator.
- 1 163 933. Hay and grain loader and carrier.
- 1 163 123. Hay retainer for hay stacker.
- 1 163 250. Baling press.
- 1 164 121. Hay press.
- 1 164 404. Feeding device for hay presses.

Dairying machines and implements.

- 164 879. Centrifugal separator.
- 164 887. Butter forming machine.
- 164 889. Apparatus for milking cows.

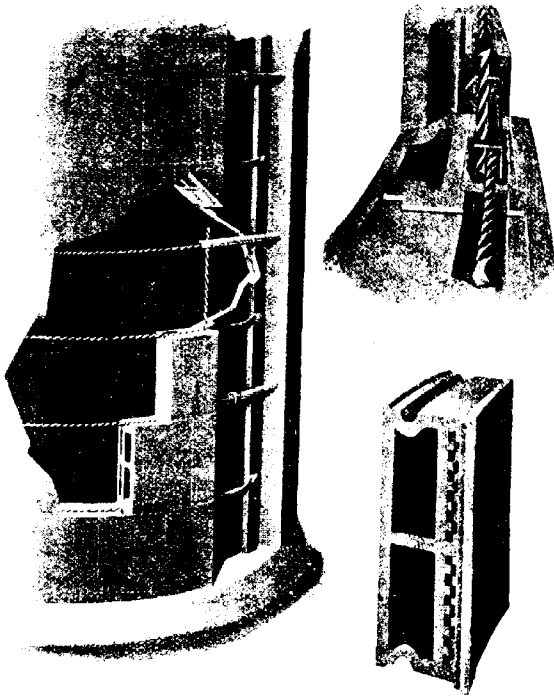
- 164 341. Safe for milk.
 164 344. Churn.
 164 346. Cream separator and churn.
 Cuba 164 357. Vessel for the carriage of milk.
 Sweden 164 358. Churn.
 164 359. Bearings for shaft of separator.
 164 360. Device for suction milking machines.
 164 361. Milk-trainer.
 164 362. Arrangement of plates in separators.
 Switzerland 164 363. Device for the carriage of dairy produce.
- Office agricultural machincs and implements.*
- Canada 194 574. Basket trimming machine.
 194 576. Machine for making plough point moulds.
 195 578. Straw feed mechanism for stores.
 Cuba 204 366. Improvements in the mechanism for regulating the
 the crushers in sugarcane mills.
 204 355. Improvements in sugarcane mills.
 204 368. Automatic filter for sugarcane juice.
 204 369. Apparatus for treating sugary juices with sulphur.
 204 370. Method of clarifying sugarcane juices.
 France 474 375. Curry comb.
 475 752. New process for pulverising bones for their direct use in
 culture.
 Sweden 70 438. Agricultural tractor.
 Switzerland 71 571. Device for broaching and drawing off liquids, especially
 fermented fruit juices.
 71 572. Cask bung with means of preventing the entrance of air
 fermentation into the cask and its refilling.
 United Kingdom 18 369. Apparatus for treating excresses etc. to form manure.
 19 274. Machine for peding osiers.
 19 286. Apparatus for extracting hops.
 United States 1192 366. Steering and draught apparatus for trailers.
 1193 366. Draught equalizer.
 1196 368, 1194 367. Tractors.
 1194 369. Traction machine.

333 **The Lansing Silo.** *Farm Implement News*, Vol. XXXVI, No. 48, pp. 271-283.
 Illinois, December 21, 1918.

The Lansing silo, manufactured by the G. M. Preston Co. of Lansing, Mich., is built of vitrified tile, one of the most durable substances known. Apart from the durability, another feature which recommends it is the air space in the centre of the blocks which render it non-conducive to heat. This type of silo can be strongly advised where the temperature falls very low with the chance of freezing the ensilage.

The accompanying illustrations give a good idea of the machine.

has a ship-lap joint which makes each block grip its neighbour. It is reinforced by twisted steel rods embedded in concrete in construction strong enough to withstand any pressure that could be developed from within.



"Lansing" Silo.

The Lansing silo has a continuous doorway and a ladder easy to climb. A doorway runs to the foundation. The doors are of California redwood and are fitted to fit perfectly against the tile in silos of different diameters.

RURAL ECONOMICS.

Managing Alfalfa Pastures in Arizona. — CLOUTIER Prof. R. W. in *The Country Magazine*, Vol. LXXX, N^o 48, pp. 1792. Philadelphia, 27 November 1915.

In the report made by the writer for the U. S. Department of Agriculture Bureau of Farm Management, a farm near Yuma, Arizona, is mentioned

Management of an Alfalfa Farm.

Date	Number of days pastured	Field A 18 acres	Field B 18 acres	Field C 40 acres	Field D 40 acres	
March 15-April 6	22	67 cattle	67 cattle			
March 23						
April 15					40 tons hay	
April 24					60 tons hay	
May 18			27 tons hay			
May 14-June 3	20	130 cattle				
June 3-June 11	11		130 cattle			
June 10				50 tons hay		
June 14-June 26	12			130 cattle		
June 26-July 14	18					
July 14-July 25	11	140 cattle 18 mules				
July 25-August 5	11		140 cattle 18 mules			
August 3				10,000 lbs seed 50 tons hay		
Aug. 5-Aug. 19	14		140 cattle 22 mules			
Aug. 19-Aug. 28	9				142 cattle 22 mules	
Aug. 28-Sept. 3	7	142 cattle 22 mules				
Sept. 3-Sept. 10	7		142 cattle 22 mules			
Sept. 10-Sept. 22	12			142 cattle 22 mules		
Sept. 22-Oct. 5	13			142 cattle 22 mules		
Oct. 5-Oct. 18	13				142 cattle 22 mules	
Oct. 18-Oct. 25	7	142 cattle 3 mules				
Oct. 25-Nov. 1	7		142 cattle 12 mules			
Nov. 1-Nov. 22	21			138 cattle 16 mules		
Nov. 15-Dec. 3	18		120 cattle			
Dec. 3-Dec. 22	18				113 mules	
Dec. 14		10 tons hay				
Dec. 15-Dec. 25	10		136 cattle			

over an irrigated area of 140 acres, alfalfa is grown for hay, for seed and for pasture, the live stock consisting of matured steers and mules.

The 140 acres of alfalfa are divided into five fields, two of eighteen acres, two of forty acres each, and one of 24 acres.

The animals are pastured turn and turn about. After a field has been grazed it is watered and allowed to remain till another crop has matured.

By following this system these five fields were made to furnish 261 tons of pasture to 139 animal units and in addition they produced 247 tons of hay, 10,000 pounds of alfalfa seed, and 50 tons of alfalfa straw. An acre of 140 acres maintained the equivalent of 141 animal units for five months and produced a surplus of hay and seed which sold for \$50. The cases of bloat were greatly reduced, being only three head during the last twelve months. The yield of feed is much greater than by a system of continuous pasturing, and the soil is always in the best of condition owing to the absence of stock from the fields when they are wet. The alfalfa is maintained and there are no noxious weeds. The accompanying table gives the season's pasturing schedule for the five fields.

Relation of Investment to Farm Profits in the Dairy Farms of Wisconsin
 by D. B. in *Hoard's Dairyman*, Vol. L, No. 20, pp. 631 and 658. Fort Atkinson., Wis. 1915.

Statistical data, collected from the owners of 80 dairy farms in Wisconsin, have given the following results: Distinguishing the farms according to size, the first group of 36 farms averaged 136 acres and had on the average a total investment of \$18 500. The average profit on these farms, on all farm bills were paid, was \$1261 a year.

The second group of 44 farms averaged 204 acres in size and these had an average investment of \$33 200. The net profit on these farms was but \$504 a year. The difference in investment in these two groups of farms is primarily, to more acres and to larger and more elaborate buildings. These comparisons showed that the too-large farm does not pay as well as the smaller and better managed place. Neither does it pay to build larger and better buildings than are required for necessary comfort and convenience. Financial records, secured from 390 farms with silos and 141 farms without silos, have shown the yearly net profit on the first to be \$775 a farm, and on the second \$525 a farm. The difference in favour of farms with silos is \$340 a farm, which is enough to pay for a good silo once over.

Distinguishing the first 80 dairy farms mentioned according to invested capital a first group of 55 have an average of \$3515 invested in operating working capital, or 15.5 per cent of the total capital. These farms made a profit of \$418 a farm a year.

The second group of 25 farms had an average of \$10 475 invested in operating capital, or 29.5 per cent of the total capital. These farms made a profit of \$2312 a farm a year.

The writer therefore believes that to obtain good results the working capital of a dairy farm in Wisconsin should not be less than 25 per cent of the total capital.

The Cost of Milk Production in the Counties of Kent and Surrey; Further Report.—GARRAD, G. H. (Agricultural Organiser for the County of Kent) in *Fourth Report on the Cost of Food in the Production of Milk in the Counties of Kent and Surrey, South Eastern Agricultural College, Wye*, 95 pp., 25 tables, London, 1915.

The present report deals in detail with the period from May 1st 1914 to May 1st 1915 and summarises the results of the past 3 years' work on investigation of the cost of milk production in the two counties named. The mass of information contained in the paper enables a close analysis to be made of the economics of milk production under the particular conditions.

In calculating the cost of feeding the same cost-of-production prices were taken as in previous years i. e. Hay 60/- per ton, Oat Straw 40/-, Barley 50/-, White Turnips 8/- and Chat Potatoes 20/-. These figures are the best estimates supplied by farmers. All purchased foods are charged at full price and no deduction has been made for the manureal values of solid food. Nor was any allowance made for attendance on the cows, only the value of the food fed being considered.

The value of pasture was calculated from the acreage grazed and the current rent per acre, allowance being made for variation in the quality of pasture above or below the average. Aftermath was valued at 15% of the rent per acre and calculation based on this figure and the average yield.

Soiling crops were charged to the cows at the estimated cost of cultivation, manures, seed, cutting and carting, rent, etc.

The year was divided into 2 periods of 26 weeks, from 1st November to 1st April, and 1st May to 30 October.

Tables I and II summarise some of the more important results:

The following recommendations are appended to the Report:

1. The amount of Concentrated Foods supplied to the cows should always be measured and related to the milk yield of each individual.

2. The cost of keeping each cow should be calculated or estimated, and all unprofitable cows culled from the herd as soon as possible.

3. All the best cows should be put to a bull of good milking strain and the heifer calves culled in this way the milk yield of the herd can be improved from year to year.

4. No improvement can be expected unless the milk records of the bull's dam and grand-dam are considerably higher than the herd average.

5. To supply the necessary information for carrying out the above recommendations a system of Milk Records is absolutely essential. Weighing the milk one day each week is sufficient; the total yields calculated from weekly weighings will not vary from the actual figures more than two per cent.

6. Where possible, join a Milk Recording Society. Properly checked milk records are valuable that are of any value for sale purposes, and the visits of a recorder act as a judicious means of ensuring that the records are kept up-to-date.

7. The services of the milk recorder will become just twice as valuable if he is employed to weigh the weights of the food as well as the milk at each of his visits, and to calculate out the composition of the ration.

For previous report *B.* April 1914, No. 378, and for other articles on the cost of milk production *B.* Feb. 1912, No. 391; *B.* April 1912, No. 706; *B.* Dec. 1913, No. 1386; *B.* Jan. 1914, No. 1401. (Ed.).

TABLE I. — *Cost of Summer Feeding and Milk Production of an Ayrshire Cow*
(1st May to 30th October).

	1912 (592 Cows)	1913 (633 Cows)	1914 (617 Cows)	1915 (617 Cows)
Average Cost of Food per Day	5.86 d.	5.45 d.	8.16 d.	7.10 d.
Daily Yield in Gallons	2.22	2.30	2.16	2.16
Cost of Food per Gallon of Milk	2.64 d.	2.37 d.	3.78 d.	3.28 d.

TABLE II. — *Cost of Winter Feeding and Milk Production of an Ayrshire Cow*
(1st November to 30th April).

	1912-13 (412 Cows)	1913-14 (632 Cows)	1914-15 (619 Cows)	1915-16 (619 Cows)
Average Cost of Food per Day	12.29 d.	12.12 d.	12.50 d.	12.11 d.
Daily Yield in Gallons	2.13	2.26	2.14 d.	2.19
Cost of Food per Gallon of Milk	5.77 d.	5.36 d.	5.84 d.	5.53 d.

(8) For economical milk production, cows which will milk well on a moderate ration are absolutely essential. High feeding will only to a limited extent increase the flow of milk and is always an expensive proceeding.

(9) Long Hay should always be fed in moderation and no wasteful feeding of it. There is every indication that the cost of milk production can be reduced by limiting the amount of Hay, especially Long Hay, and replacing a proportion of it with Oat Straw.

(10) The feeding of large quantities of Roots (above 60 lbs) appears to be uneconomical.

(11) To produce cheap milk in the summer a large area of cheap grass is a very important factor, and a limited area of grass combined with heavy indoor feeding is not a good substitute.

(12) Cheap milk production in the winter depends more on attention to the quantity and proportion of the various foods in the ration than on the purchase of any one particular cake or meal.

(13) A variety of food-stuffs is better than any single food. The cost of feeding should always be kept in mind and the price of the foods as well as their composition should be known before purchase.

(14) Each farmer must judge for himself which foods he can utilise to the best advantage, what he should buy and what he should grow. The home-grown foods should be obtained as cheaply as possible and in suitable quantities.

(15) No amount of scientific feeding will be successful unless both the farmer and the cowman take an intelligent interest in the welfare of their cows.

AGRICULTURAL INDUSTRIES

Food Value of Different Types of Bread.—PUGHSE, A. in *Nature*, Vol. VI, Part 1, December, pp. 254-275. Milan, 1915.

The types of bread studied in these experiments initiated by the "Museo dell'Umanitaria" at Milan were as follows:

A: *Normal type.* — Made with a 75 per cent flour in use before the Government imposed "Standard" bread.

(3) "Standard" bread imposed by Government. - Made with 80 per cent flour used in experiments before the Government law was passed (14).

Dark type with bran. - Made from cleaned flour 85 per cent

(c) *Mixed type.*—Containing 82 parts of 80 per cent cleaned flour and 18 parts of maize flour.

The experiments were conducted with 6 workmen from the "Umioni" Workhouse and were medically certified as being healthy and vigorous. With regard to its nutritive qualities and heat value the ration was similar to that used in the previous inquiry by the "Umioni" on the food budget of the Milan working class family.

The energy value of the rations per day calculated in calories by Atwater's method was as follows:

Ingredient	Weight (grams)	Calories
Albumen	100 gms. 30.4	470
Fat	60 " 87.5	544
Carbohydrates	485 " 56.4	1940
Wine	400 cc. 57.0	210
Total		3164 calories

Area of the bread was:

		Per cent. of total
Albumen . . .	49 gms.	15
Carbohydrates . . .	303 "	62.24
Dry Matter . . .	373 "	55.42
Calories . . .	1,430 "	45.58

Taking into account the 170 gms. of pastry or rice fed each day the calories provided :

60.00) per cent of the total albumen			
88.45	·	·	carbohydrates
80.23	·	·	dry matter
63.63	·	·	calories

per cent flour containing only the finest and almost invisible portion of the bran
making a white loaf. (Ed.).

Bread made from cleaned flour of not less than 85 per cent purity, of a dark colour lacking the larger bran particles. (Ed.).

As in the case of the experiment with the workman's family, the diet was characterised by a considerable predominance of albumen of vegetable origin and by a markedly small proportion of fat.

The experiment lasted 30 days and gave the following results.

From the first period (with 75 per cent bread) to the second (B) (dark type with bran) all the curves showed a rapid rise, then fell in the third period (75 per cent bread) rising again slightly during the fourth period (80 per cent bread) this rise being maintained with the introduction of bread.

The most intense effects were observed with the dark type bread in the second period, during which the quantity of faeces doubled. Nothing also occurred with the percentages of dry matter, water and ash. Further, the effects of the bread containing bran continued until a few days of the following period. Standard bread from 80 per cent flour (B) however, produced none of the effects of the dark type bread, and only showed a little more stimulating effect on the intestine than the flour of 75 per cent cleaning. The mixed type bread (D) was cheaper than bread made with 85 per cent flour, had a relatively higher food value and appeared preferable.

The effects of the dark type bread are due to the strong fermentative power of the bran, which accounts also for its therapeutic value, but causes a considerable loss of nutritive matter. In the second period the percentage diminution in the absorption of the different nutritive substances was highest for albumen. The utilisation of the nutritive matter in the period with standard bread was a little less than that obtained in the preceding period with bread from 75 per cent flour.

According to the results the writer considers that household standard bread made with 80 per cent flour should be continued for the sake of national economy.

339 **The Use of Pressed Apple Pomace.**—BARKER B. T. P. and GIMMINGHAM C. F. *University of Bristol in The Journal of the Board of Agriculture*, Vol. XXII, No. 5, pp. 171-172, London, December 1918.

Pomace includes the product of both apples and pears after extraction of the juice in cider making. An official estimate places the yield of pressed pomace at 44 to 53 thousand tons, whilst the writer estimates it at 40 to 75 thousand tons. Its average composition is approximately: water 75 per cent; fat, etc. 1.2 per cent; protein, 1.4; crude fibre 0.7; ash 1.2; carbohydrates (sugar, etc.) 1.4 per cent.

The various uses of pomace are as follows:

Feeding stuff. It has a nutritive ratio of 1:16. It should be fed fresh and in moderate quantities mixed with other feeds. By storing under considerable pressure to keep out the air it forms a useful silage which keeps good for several months. Dried pomace is employed in making compound cakes and poultry foods, but the cost of drying is rather expensive.

Manure. Ordinary samples of pomace contain from 0.2 to 0.6 per cent of potash, 0.4 to 0.7 per cent of phosphoric acid, and 1.6 to 1.7 per cent of nitrogen, so that it is richer than farmyard manure. Its gradual

acidity is an objection to its direct application unless lime or soda ash is added.

Preparation of Small Cider or Improving the Quality of Low-Grade Cider.

Small ciders made by extracting with water and may contain 3 to 4 per cent of sediment. Old or "tainted" cider may be improved by re-soaking with fresh pomace.

Utilization of American Flax Straw in the Paper and Fibre Board Industry.

W. H. HOSKINS, L., in U. S. Department of Agriculture Bureau of Plant Industry, Bulletin 100, p. 24 Washington, January 7, 1906.

The Office of Paper-plant Investigations of the U. S. Department of Agriculture has published the results obtained with the use of flax straw in the paper and fibre-board industry. The cultivation of flax in the United States has increased considerably and now occupies an area of about 1,000,000 acres (1) producing 20 million bushels of seed valued at 3.3 millions. The annual tonnage of straw amounts to 1.6 millions of which not more than 200,000 tons are at present put to any profitable use. The utilization of the remaining 1.4 million tons would be of immense economic value since its paper producing possibilities are equal to the annual production of wrapping paper and more than double the annual production of the paper in the United States. Its sale would represent an added income to the farmers of about \$ 5,000,000 annually and would give this material a assured place in national agriculture.

These experiments comprise the following scheme:

(1) Preliminary laboratory experiments on the utilisation of flax straw as raw material for sack or wrapping paper manufacture, particularly with regard to the pulp obtained.

(2) Paper wrapping tests on semi-commercial machines at Cumberland Falls, Mo.

(3) Mill tests on the manufacture of fibre board from flax straw on a commercial scale in Maine.

(4) Experiments on the preparation of flax tow from threshed straw at Red Wing, Minn.

(5) Manufacture of fibre board from flax tow under commercial conditions at a counter-board mill in Maine.

Although the results of these experiments have not yet definitely solved the problem of the direct utilisation of flax straw as raw material in the manufacture of wrapping paper, they have shown that it may be used (1) in the preparation of flax tow, to replace the imported tow from Europe (2) in the manufacture of counter-board.

On semi-commercial tests produced counter-board from the home grown flax tow of suitable quality for the consumers and at ordinary market prices. The tests have also shown that the domestic flax from the North can compete successfully against imported flax waste even though the manufacture is conducted as far east as Boston, and that if the manu-

(1) Average during quinquennium 1909-13.

(2) United States imports about 7,000 tons of flax waste per annum for this purpose.

facture were localised near the flax region the results would be in favour of the domestic tow.

The writer suggests cooperative action amongst the mills in a 5 mile radius with a view to establishing their own tow mill, thus placing the new industry on a safe basis.

From present indications it appears that different grades of tow can be produced for the paper industry depending upon the grade of straw to be manufactured. Thus three grades of fineness of the tow can be established according to the amount of ligneous fibre removed.

At the present time there are 10 tow mills in the flax-zone, producing from 1000 to 30,000 tons of flax straw per annum. The tow is now used chiefly as material for upholstery and packing for export goods, ware etc., whilst a small quantity is made into insulating board for generator cars and also for rough twine.

The prices of baled flax tow at St. Paul, Minn. in September 1915, Coarse \$ 1.10; medium \$ 1.18; fine \$ 2.41; extra fine \$ 3.32 per cwt., whilst the baled straw was selling at \$ 7 per ton.

This tow is naturally a different product from that obtained from flax mills.

The laboratory and commercial investigations will be carried along wrapping paper and writing-paper lines in order to develop a paper which will absorb an appreciable amount of this large and present valuable crop waste.

314 **Strength Tests of Structural Timbers Treated by Commercial Wood Preservative Processes** — BEERS, H. S. and NEWBURN, J. A. in U. S. Department of Agriculture, No. 276, 15 pp. 7 diagrams, Washington, September 27, 1915.

This bulletin presents the results of tests made by the Forest Service of the U. S. Department of Agriculture, in cooperation with the Great Central Railway and some wood-preserving companies, to determine the strength of bridge stringers is affected by commercial preservation treatments. To do this, comparison was made between the strength of treated and untreated stringers of the same size and quality. The timbers were Loblolly pine, (*Pinus taeda*) Longleaf pine (*P. palustris*), and Douglas fir (*Pseudotsuga douglasii*).

The preservative treatments to which the timbers were subjected are as follows:

The physical properties of the timbers were determined before and after the treatments. The results were as follows:

Loblolly pine. Showed an evident weakening due to the treatment, probably not more than 17 per cent. The fibre strength at elastic limit and the stiffness both show a greater weakening due to treatment than does the breaking strength.

Longleaf pine. It does not appear that the breaking strength was affected by the treatment. There is a slight reduction in the fibre strength at elastic limit and stiffness.

Douglas fir. There appears to be a marked weakening of the fibre strength with the "boiling" process used. The average breaking strength

Treatment	Loblolly pine	Longleaf pine	Douglas fir
1. Untreated	4 hours	6 hours	4 $\frac{1}{2}$ hours
2. Creosote	20 lbs.	30 lbs.	60 lbs.
3. Creosote and pressure	20 inches	20 in.	20 in.
4. Creosote and pressure and heat	1 hour	1 hour	45 $\frac{1}{2}$ hours
5. Creosote and pressure and heat with creosote and pressure	125 lbs.	125 lbs.	0 to 140 lb.
6. Creosote and pressure and heat with creosote and pressure and heat	1 $\frac{1}{2}$ hours	5 $\frac{1}{2}$ hours	2 $\frac{1}{4}$ hours
7. Creosote and pressure and heat with creosote and pressure and heat and heat	140° F.	140° F.	200° F.
8. Creosote and pressure and heat with creosote and pressure and heat and heat and heat	24 $\frac{1}{2}$ in.	—	—
9. Creosote and pressure and heat with creosote and pressure and heat and heat and heat and heat	1 $\frac{1}{4}$ hour	—	—

point's fir was also boiled in creosote 21 $\frac{3}{4}$ hours at a temperature of 215° F. and from 0 to 145 lbs. in 5 $\frac{3}{4}$ hours.

Stringers tested green and after seasoning is 33 per cent and 30 per cent, respectively, less than the average strength of the natural stringers. The stress at elastic limit also appears to be reduced, although to a far less extent. In the green material no weakening is apparent in stiffness. The seasoned stringers, however, show a falling off in stiffness in the treated material.

In the "steaming" process the breaking strength and fibre stress at elastic limit of green Douglas fir was considerably less in the treated (33 and 30 per cent., respectively) and the stiffness was slightly

less. The conclusions arrived at are as follows:

1. Timber may be very materially weakened by preservative pro-

cesses. Creosote in itself does not appear to weaken timber.

2. A preservative process which will seriously injure one timber may do little or no effect on the strength of another.

3. The same treatment given to a timber of a particular species will have a different effect upon different pieces of that species depending upon the form of the timber used, its size, and its condition when treated.

Method for Detecting the Admixture of Goat's Milk to the Milk of Cows.

By H. P. PIRNAY, N. A. in *Schweizerisches Zentralblatt für Milchwirtschaft*, Year 4, No. 52, 1916, p. 1017; Year 5, No. 1 pp. 3-4, Brugg, December 30, 1915 and January 6, 1916.

Since the milk's method of determining the presence of goat's milk when admixture cow's milk is based upon the fact that the casein of cow's milk dissolves readily in ammonia at a fairly low temperature (50° C) and the casein of goat's milk is insoluble in ammonia. GABATHULER and

have perfected the method by using apparatus like the lactobutometer or the albuminometer, in which the insoluble casein of goat's

milk was separated from the rest of the liquid by centrifuging. Consequently, however, it was found that the same amount of goat's milk in samples of milk from different cows, gave rise to different quantities of insoluble sediments. These variations have been attributed by GARATHULER to differences in the breed, individuality, and the lactation of the cows, while STEINIGER and PRITZKER consider them as differences in the age of the goat's milk.

With a view to obtaining an explanation of these variations, a series of tests were carried out at the Berne-Liebefeld Swiss Dairy Technological Establishment in which were examined: *a*) the effect of the same goat's milk in the milk of different cows; *b*) the effect of goat's milk upon the flocculation of the casein of goat's milk; *c*) the effect of the content of cow's milk on the formation of the sediment of insoluble casein; *d*) the effect of the age of the goat's milk upon the result of the test; *e*) the part played by the substances used for preserving milk. The details of which are summarised by the writer in a series of papers, as follows:

- 1) The same goat's milk, when mixed in equal quantities with samples of milk from different cows, produces variable quantities of sediment.
- 2) The amount of sediment formed in a mixture of goat's milk with colloidal solutions decreases with the decrease in the concentration of the colloidal solutions used.
- 3) The addition of distilled water to cow's milk, or the dilution of the colloidal concentration of cow's milk, diminishes the amount of sediment formed by the casein of the goat's milk.
- 4) When absolutely fresh goat's milk is added, the increase in the albumen content of the cow's milk causes an increase in the amount of sediment of insoluble casein.
- 5) The amount of the insoluble casein deposited diminishes with the age of the goat's milk used.
- 6) Amongst the substances used for preserving milk, formalin has an unfavourable effect upon the formation of sediment, while bicarbonate of potash promotes its formation and brings about a very marked separation of the sediment from the serum.
- 7) The formation of the casein deposit is also promoted by the skimming of the mixed milk that is to be examined.

On the basis of these results, the writer recommends the following method for detecting the presence of goat's milk when mixed with cow's milk:

To the sample of milk to be examined are first added from 1 to 2 cc. of cold saturated solution of bichromate of potassium per 100 cc. of milk, and the milk is completely skimmed. 20 cc. of the skimmed milk is placed in a SCHMID albuminometer, or in a GARATHULER tube, and 20-25 per cent ammonia are added. The milk, after having been left for 1 hour in the water-bath at a temperature of from 45-55° C., is again centrifuged at very high speed. The formation of sediment in the tube is proof that the milk examined contains goat's milk. The writer is

the presence of a minimum of 10% of goat's milk can be determined with certainty, but the absence of sediment does not prove the absence of any goat's milk.

The Microscopic Analysis of Meat and Fish Meals.—LECKS, R. in *Lebensmittelchemische Zeitsung*, Year 64, Nos. 10-10, pp. 508-511, Stuttgart 1915.

Although meat and fish meals have been used for some time past as fertilizers, no exact method has yet been discovered for distinguishing them or for determining their degree of purity. They are thus easily adulterated by the addition of either plant or animal matter. In the latter case it is often a question of the addition of a bad quality of meat meal from the carcasses of animals that have died of epizootic diseases. A meal thus adulterated can be a continual source of numerous cattle diseases.

The distinction of meat meals from fish meals can be based upon some of their constituents. The muscular tissue in meal made from the flesh of animals is relatively very characteristic, but it is impossible to distinguish it from the muscular tissue in fish meal.

The elastic and conjunctive tissue are of no use in diagnosis. When mixed the blood corpuscles of different animals are very unlike, but in meals they are so much altered as to be unrecognisable. Hairs and scales are very characteristic and can be distinguished in meals, even if they are present in small quantities. As regards the bony particles, these, in the opinion of the writer, serve to distinguish the meals from one another. In a meat meal, except American, pieces of bone are present, sometimes in large quantities. In the same way, fish bones are to be found in fish meals. The difference between the structure of the bones of mammals and that of fish bones allows of the two kinds of meal being fairly easily distinguished from one another.

The microscopic method devised by the writer for this purpose is as follows:

Part of the meal to be analysed is well ground, the rest is kept as it is, so that some time the changes in it caused by keeping are studied. 5 gr. of the ground flour are placed in a porcelain dish and treated with chloroform. After $\frac{1}{2}$ to 1 minute the results are observed; if the meal contains mammal or fish bones, their debris forms a deposit at the bottom of the dish, while the muscular portions float on the surface of the liquid. These particles are decanted off with the chloroform, and the remainder is well washed in ether and subsequently examined under the microscope. The mammalian bones are easily distinguished from the fish bones, from the shape of the lacunae separating the lamellae of the bones. These lacunae, though regularly present and well-developed in the bones of mammals, are often wanting or only slightly developed in those of fish. This character is absolutely reliable.

A second portion of the ground flour (5 gms.) is placed in a porcelain dish, then mixed and heated with 200 cc. of 50% nitric acid. After boiling, the meat meals assume a blackish-yellow colour, while fish meal

becomes a yellowish-brown, if made from herrings, and light yellow, if composed of cod.

A small portion of the meal treated with nitric acid is examined microscopically. As the acid has dissolved the line of the bones, it cannot serve any more as a means of diagnosis. On the other hand, muscular fibres are very characteristic. The rest of the meal treated with nitric acid is put in a porcelain dish and heated with about 10 cc. of 2% lye of caustic soda. It is found that by this means nearly all animal tissue present in the meal is destroyed, while the plant matter is relatively well preserved. The whole is filtered, and the residue on the filter is examined under the microscope; if it consists of plants and pieces of wood etc., it may be concluded that the impurities in the meal come from the packing material. If there are also other impurities, such as straw, hay, grains of oats, barley etc., bran, fragments of potato etc., it may be concluded that one is dealing with a meat meal made from carrion, the probability being that such carrion is derived from animals that have died of some contagious disease.

- (11) **Bacteria in Fresh and Preserved Eggs.**—I. CALDWELL, W. D. *Bacteria in Fresh Eggs*.—II. MASON, OLIVER M. *Bacteria in Preserved Eggs*. *Science*, N. S., 1913, No. 4076, pp. 121 and 123; Lancaster, Pa., 1913, (11).

I. (11) This paper presented the results of a bacteriological study of fresh eggs carried on at the Agricultural Experiment Station of the New Island State College. The results are, briefly, as follows:

1. Of 2,310 fresh eggs from 65 hens, examined by the indirect method, 8.8 per cent. showed infection in the yolk.
2. None of 111 whites examined showed infection, while those of the same eggs gave a percentage of infection (4.5) less than the average for the series (8.8).
3. The percentages of infection obtained for individual hens varied between 2.8 and 15.0, the average being 8.0 per cent. per year for hen laid sterile eggs during a whole year.
4. No correlation was observed between the percentage of infection for any individual and the degree of fecundity of that individual.
5. Approximately the same amount of infection was found in fertile eggs (6.0 per cent. infected out of 422 eggs examined) as among tile (3.6 per cent. infected out of 315 eggs).
6. The infection of eggs in the degree made apparent by the test studies seemed to have no unfavorable effect upon their hatchability.
7. Practically no difference between the percentages of infection of eggs from pullets and from hens in their second laying year was observed.
8. No definite seasonal variation was observed in the bacterial content of the eggs examined.
9. No definite conclusion can be drawn from these studies regarding the influence of temperature upon the detection of infection in fresh eggs.

(11) See *B.*, Feb., 1913, No. 771 and *B.* July, No. 750.

From 57 infected eggs out of 737 examined in one of the series, 37 organisms were isolated, among which were seven cocci, eleven motile bacilli, four non-motile rods and one spirillum.

On petri plates exposed under the hood in which the examinations were made, a variety of organisms, largely chromogens. This series of organisms did not resemble the series of egg organisms.

In tracing the source of infection, this study indicated that the penetration of the shell after the egg had been laid, or infections during the passage of the egg through the cloaca, or during fertilization, or while the albumen and yolk were being deposited, are, to say the least, uncommon. It is more likely that infection of fresh eggs is largely due to occasional infections with harmless organisms taking place within the ovary of the hen.

Commercial and strictly fresh June eggs packed in solutions of 1:1:20 parts commercial waterglass and in saturated lime solution, stored in laboratory, barn cellar and at 34° F. Thermograph recorded. Bacteriological and chemical examinations were made, before experiments and parcel-post shipments.

At a temperature of 80° F. in laboratory permitted rapid multiplication of bacteria. Eggs. Barn temperature varied from 10° F. to 87° F. Eggs froze in winter, later some thawed without breaking and at end of experiment no effects attributable to freezing. Bacterial content was uniformly low. Bacterial increase in commercial eggs in 1:10 waterglass solution, especially in albumen, during first two months of storage. Eggs in cellar held a uniformly low bacterial content throughout. At 34° F. eggs showed exceptionally low counts. Water-glass contained practically no bacteria after five months of storage. Bacterial content of eggs in nearly every lime solution increased rapidly than in waterglass, necessitating the discarding of these solutions early in experiment.

Graphs were plotted showing increase of average bacterial content in length of storage. Bacterial content of albumen in most cases was lower or equal to that of yolks for 150 or 250 days of storage. Yolk bacterial content increased markedly and generally far exceeded that of albumen.

From spoiled eggs were isolated: *Micrococcus aurantiacus*, *Bacillus probacillus subtilis*, *Bacillus pyocyaneus*, *Bacillus fluorescens-luminescens*, *Staphylococcus aureus*, *Bacillus termo*, *Bacillus subtilis*. One decomposed egg contained bacteria in large numbers.

York State's Apple Auctions. *The Outlook*, pp. 116-117, New York, 1914.

One of the most difficult problems for solution is the bringing together of the producer and the consumer. A notable experiment in this direction is being made by the New York State Department of Food and Markets, under the supervision of a system has been begun whereby the apples of the fruit districts of the State may be sold on the farm, by public auction, and the buyers themselves requested and arranged for these auctions. In-

stead of a dozen men, each offering the produce of his own orchard, they grouped their holdings and offered twenty thousand barrels to the highest bidder. The buyers were invited to inspect the fruit as it hung on the trees, and then came out with a fair open bid for what they thought it was worth.

The first sale of this character, held in Red Hook, New York, was in 1892, establishing a public wholesale price for apples, running from fifteen to twenty-five cents a barrel above the prices established at private sales. It has since also in bringing into the competition many buyers who had before never come in contact with the farmer.

It is the ultimate hope of the Bureau of Food and Markets to establish in New York City a union freight terminal to receive and distribute food products. This terminal will contain, it is planned, auction rooms, play rooms, and ample facilities for the sale as well as the physical display of farm products. This terminal would serve as a wholesale market from which both the grocer and the jobber who could best render the necessary service of distribution could economically obtain his supply. The plans of the Department also contemplate more efficient methods of assembling, grading, and packing food products at the producing centers.

This system of public auctions represents the application of a general principle. The bananas that arrive in New York City from the largest ship and importers, almost all the California fruit, the two or three millions worth of Almeria grapes which come from Spain every autumn, lemons, and Florida oranges are all disposed of in this public and open manner. The interesting and vital factor in the case rests in the fact that the work is being undertaken by New York State for the benefit of its farmers and its own consumers.

340. **Regulations for the Commerce of Fruit in Cases, in Queensland.** (*Commonwealth Year Book*, Vol. IV, Part 1, p. XI of Appendix, Brisbane, N.S.W.)

"The Fruit Cases Act of 1912" coming into force on the 1st June, prescribes that all fruit sold in cases or exported to any place within the Commonwealth must be in cases of the dimensions mentioned below, with the same as those required in New South Wales.

Bananas are excepted from the operations of the Queensland Act. The regulations further prescribe that :

- 1) All cases for the Queensland trade must be new or clean and free from insect or fungous diseases.
- 2) New cases only must be used for fruit exported to any of the Australian States.
- 3) New cases only must be used (under any circumstances) in fruit districts of Stanthorpe and Bowen.

Every case, whether the fruit is for sale in Queensland or in an Australian State, must have legibly and durably on one end of the top of the case :

- a. The name and address of the packer of the case.
- b. The words "guaranteed by packer to contain 1 Imperial bush" or as size of the case may warrant.

Inside measurements of fruit cases clear of any divisions.

	Length	Depth	Width
	inches	inches	inches
1. Apple Case	18	14 $\frac{1}{4}$	8 $\frac{2}{3}$
2. Orange Case	20	14 $\frac{1}{4}$	6
3. Peach Case	20	10	11 $\frac{1}{8}$
4. Pear Case	18	7 $\frac{1}{8}$	8 $\frac{2}{3}$
5. Plum Case	26	7 $\frac{1}{8}$	6
6. Apricot Case	18	5 $\frac{1}{4}$	11 $\frac{3}{4}$
7. Pineapple Case	15 $\frac{3}{4}$	4	10 $\frac{1}{8}$
8. Tropical Fruit Case (for Pineapples, etc.)	24 $\frac{3}{4}$	12	12

For the case of the Tropical Fruit Case the guarantee should be — " guaranteed by maker to contain not less than 3 504 cubic inches ".

The above name, address and guarantee should be at least 5 inches long and 3 inches wide but stamps 3 inches by 1 $\frac{1}{2}$ inches and upwards will be accepted.

Exception. — The Act will not apply to the sale of fruit sold in trays, dishes, casks, or buckets, or to crates which contain trays of fruit. Fruit packed, however, must have marked on the package the weight or number of its contents.

Penalties are provided for persons who :

1. Pack fruit for the Queensland trade in disease-affected cases.
 2. Export fruit to another Australian State in second-hand cases.
 3. Obstruct or refuse to give information to an Inspector who is carrying out the Act.
 4. Place an incorrect guarantee on a case.
 5. Export fruit in a case carrying an incorrect guarantee.
- After the size of a case bearing the packer's name, address, and contents.
6. Interfere with the packer's name, address, or guarantee on the case.

Co-operative Poultry Marketing in Saskatchewan. *The Public Service Monthly Bulletin of Agriculture*, Vol. IV, No. 8, p. 100, Regina, Sask., December 1915.

The Provincial Department of Agriculture of Saskatchewan, Canada, announces that a Poultry Killing and Marketing Station, under the joint sanction of the Poultry Husbandry Section of the College of Agriculture, will be operated in Saskatoon. Poultry producers in the territory tributary to Saskatoon are invited to ship their live birds to this station where they will be received by the Poultry Husbandry Department which will supervise the killing, dressing, grading and packing of the birds. The Cooperative Organization Branch will take delivery of the dressed birds and will forward the proceeds to the producers at graded prices, consistent with the

quality of the birds. The poultry will be either sold immediately, should the prices be low at the time, placed in storage, until a satisfactory price can be obtained. When all the birds have been disposed of, the payment will be sent to the producers which will return to them the amount realized from the sale of their birds, less the actual cost of transportation, killing, boxes and storage charges.

Through this project the Department hope to be able to place on the market a considerable quantity of choice poultry, properly dressed, which will bring the producers a price considerably in advance of that which they have in recent years.

Through the month of November the poultry marketing car stopped at points along the Canadian Northern Railway from Wadena to Roseau. The number and quality of the birds delivered at the car has steadily increased; it comprised chickens, turkeys, ducks and geese.

PLANT DISEASES

DISEASES NOT DUE TO PARASITES OR OF UNKNOWN ORIGIN.

1. **Growth Incompatibility of Oak and Olive Trees.** — PIERI L., in *Atti della Reale Accademia dei Lincei, Classe di Scienze fisiche, matematiche e naturali*, Vol. XXIV, 1905-6, 5, Part. II, pp. 530-532, 1 fig. Rome, 1905.

It has been common knowledge for some time past that olive trees are generally stunted in their growth when in the vicinity of oak woods. This may be explained either as the consequence of an excessive impoverishment of the soil, or as a kind of antagonism that may eventually occur between the roots of the two species of plants. Starting from the latter supposition, the writer has carried out a series of pot-cultures in which young olive and oak plants were grown together at intervals of 10 cms. Careful examination of the one year old oak roots grown in contact with the olive roots has shown the existence of small brown zones in correspondence with which the primary cortex, in process of being shed owing to the formation of the periderm, is seen to be in an advanced state of decay. Under the microscope these brown zones show occasional lobed vesicles of irregular shape originating from the extremities of thick mycelial filaments. The formation of these vesicles takes place in the deep strata of the cortical parenchyma.

The characters of the mycelium and of the vesicles correspond exactly to those of the mycelium and vesicles found in the endotrophic mycorrhizae of the olive. The penetration into the one year old oak roots undoubtedly takes place shortly before the formation of the periderm. It is therefore merely a weak parasitism occurring on a dying tissue.

It is interesting to note that the one year old olive roots show no trace whatever of the infection, which leads to the conclusion that the olive roots are, at a certain distance from the apex, less receptive of this organism than the oak roots. The ectotrophical mycelium of these latter has apparently no parasitical action on the olive.

It may therefore be concluded that the failure of the olive tree observed in the neighbourhood of oak woods is probably caused by oaks having impoverished the soil, or by the eventual decay of the soil due to the development of *Dematophora* in the soil remains. The effect of any injurious action due to the mycelium of the diseased oak roots, can be totally discarded.

DISEASES DUE TO BACTERIA, FUNGI AND OTHER LOWER PLANTS.

- ERRATUM 349. **Contribution to the Mycological Flora of the Tyrol.** (11). — BUBÁK FR. (1915).
F. F. in *Annalen Mycol.*, Vol. XIII, No. 2, pp. 107-114, Berlin, 1915.

A list containing a large number of fungi observed in the Tyrol, of which are new to science. Amongst others the following may be noted: 1) *Phyllosticta translucens* Bubák et Kabát n. sp., on living leaves of *Ulmus nigrians* (L.) ; 2) *Aschochyta Juglandis* Boltsh., on living leaves of *J. regia*; 3) *Septoria Drehtalis* Pass., on living leaves of *Drehtalis lutea* (L.) ; 4) *Septoria fuscomaculans* Kabát et Bubák n. sp., on living leaves of *U. paniculatum*; 5) *Melaninia Lonicerae* Jacezewski, hitherto found only in Asia; the fungus collected in the Tyrol, which is perfectly identical with the Asiatic one, develops on the living leaves of *Lonicera* (L.) ; 6) *Colletotrichum exiguum* Peuz. et Sacc., on living leaves of *Spina* (L.) ; the spots, which are very numerous on the margins, are small, and either light or dark brown in colour, edged with purple-brown; is considered to be possibly a form of the same *Colletotrichum* already known in Italy; 7) *Ocularia pulchella* Sacc., on living leaves of *Tritium* (L.) ; 8) *Ramularia Epilobii rosei* Lindau, on living leaves of *Epilobium* (L.) ; 9) *Cladosporium myricicola* Bubák n. sp., on leaves of *Myrtus* (L.) ; 10) *Cercospora avicularis* Went., on living leaves of *Polygonum* (L.) .

350. **Dimorphism in *Coniothyrium pirinum* Sheldon.** — CRYMDE, C. H. (1915). *American Journal of Botany*, Vol. II, No. 9, pp. 449-460. Figs. 1-18, Lancaster, 1 November 1915.

The writer has often observed that *Coniothyrium pirinum* Sheldon sometimes dimorphic in culture and is probably so also in nature. Two distinct strains have been isolated, a plus strain which fruits abundantly and a minus strain, which fruits poorly.

The minus strain arises in artificial culture by sudden spotting the plus strain. This phenomenon has been observed in four separate instances. Minus strains never give rise to plus strains but remain, or degenerate after generation.

Attempts to develop the strain from each other by continuous selection of extremes have been unsuccessful. Attempts to determine the cause of the spotting have been fruitless.

(1) See also *B. Annot.*, 1914, No. 788, and *B. March* 1915, No. 14.

the plus and minus strains of *Coniothyrium pininum* have been used to inoculate apple leaves. In two weeks the spots inoculated with each strain enlarged and bore several pycnidia from which it was easy to re-isolate again. The culture show that both the strains retained their diagnostic characteristics. One month after inoculation no enlargement of the sealed spot taken place. In fact some of the dead tissue bearing pycnidia elements had fallen out, producing a "shot hole" effect. This is further proof that *Coniothyrium pininum* is a saprophyte.

The Persistence of Viable Pycnospores of the Chestnut Blight Fungus (*Endothia parasitica*) on Normal Bark below Lesions. - STEPHENSON A. R. and HEALD F. D. in *American Journal of Botany*, Vol. II, No. 4, pp. 162-168, Lancaster, 1914.

The writers have studied the part played by birds and insects in the expansion of the chestnut blight fungus, *Endothia parasitica* (Murr.) the results they obtained may be summarized as follows:

1. The rains wash down from the infected portions of the tree trunks the number of the pycnospores, which lodge on healthy bark below lesions. The writers found viable pycnospores of the chestnut blight fungus on normal bark lesions in numbers amounting to 172,222 per sq. cm. of surface (1,111,176 per sq. inch). An abundance of viable pycnospores was obtained at as great a distance below a lesion as 70 cm., and appears very likely that they could be obtained at much greater distances below cankers.

2. Large numbers of pycnospores can be obtained immediately after a rain and may, within certain limits, remain viable for two weeks. It seems probable, though it cannot as yet be positively ascertained, that the number of pycnospores to resist desiccation is greater on bark below lesions than under other conditions.

3. Birds, and especially migratory birds, are capable of carrying numbers of viable pycnospores for considerable distances; and in many cases may be important agents in the local dissemination of blight. Pycnospores easily cling to the feathers and claws of birds perched on the branches searching for food in the bark of the tree trunks. The largest numbers of spores were invariably obtained from bird's feathers and from the feet and abdomen of insects, two to four days after a rain. Thus as has already been seen, washes the pycnospores in large numbers from the infected portions down the tree trunks.

Seasonal Duration of Ascospore Expulsion of *Endothia parasitica* ("Chestnut Blight Fungus") (13). - HEALD F. D. and STEPHENSON A. R. in *American Journal of Botany*, Vol. II, No. 5, pp. 429-437, Pls. 1-6, Lancaster, Pa., Nov. 1914.

Expulsion of spores from the perithecia of *Endothia parasitica* (Murr.) the chestnut blight fungus, begins in the spring with the first warm rain, it rises to a maximum of activity as conditions become more favor-

able, to be followed by a decline in the autumn when lower temperatures prevail, and ceases entirely during the cooler portions of the year. The rainy season may be an abundant rainfall. During 1913, the period of activity extended from about the middle of March to the middle of November. In 1912-13 there were 19 rain periods during the autumn, winter, and spring, with no expulsion of ascospores, and in 1913-14 there were 19 rain periods, induced no expulsion of ascospores. During one third to one half of the year there is then no expulsion of ascospores, but during the remainder there is an abundant expulsion with each rain of any consequence (except snow cover) except in a few instances when the temperature drops below freezing. Perithecial pustules of the chestnut blight fungus show a long period of power of spore production. This power is not exhausted during the course of a single season, and in many cases is as marked during the second season as during the first.

The writers believe that the results of their observations lead to the conclusion that pustules first producing mature perithecia in the autumn may continue to be a source of spores during the following seasons of perithecial activity, the maximum of production occurring during the season following their maturity with a gradually decreasing production of spores during the next season.

This remarkable power of *Endothia* which is not in accordance with what is known regarding many other pyrenomycetous fungi whose period of perithecial activity is very short, is due to successive maturing of successive maturing of perithecia, and the successive maturing of perithecia throughout the season.

353 Effect of the Destruction of the Barberry (*Berberis vulgaris*) on the Common "Rust" of Wheat (*Puccinia graminis*) in Denmark

Lidskrift for Planteavl, Vol. XXII, Part. 3, pp. 72-750, Copenhagen, 1903.

With the law dated March 27th 1903, the Danish Government issued a series of regulations regarding the complete eradication of *Berberis vulgaris*, the well known intermediate host plant of *Puccinia graminis*.

The good results obtained up to the present wholly justify the mentioned regulations which, at the time of issue, were a cause of some controversy.

During the last ten years the results obtained have been:

- 1) The gradual disappearance, contemporaneously with the destruction of the barberry, of the "rust" (= Sortrusten") caused by *P. graminis*;
- 2) The severe attacks of "rust" which before 1903 used to occur every two or three years throughout the whole country, have no longer occurred;
- 3) The slighter attacks occurring on barley, forage grasses, and in Jylland even on oats, have also almost entirely stopped;
- 4) In the few places where the plant has not been destroyed, the rust still causes damage to the barley crops.

Against the above results one has only to bear in mind that before 1903, the damage caused by "rust" amounted to over 10 per cent.

An extensive bibliography is appended.

Observations on the "Dwarfing" of Barley and on the Specific Resistance of Certain Graminae to several Species of Uredinaceae and Ustilaginaceae. HENNING

Årsmöte i Sveriges Utsädesförenings Tidsskrift, Year XXV, pp. 130-137, Stockholm, 1915.

Investigations carried out at the Experimental Station of Ultuna, Sweden, led to the discovery of numerous cases of "dwarfing" of barley, especially in the types 01 254 and 01 257 where as high a proportion as 80 per cent of the crops may be affected.

In the affected plants the stalks do not grow higher than 50 or 60 cms. The ears have an average length of 2.3 cms. The six rowed and early maturing barley are more subject to "dwarfing" than the two rowed types.

The disease may have been caused principally by the severe drought experienced that year in the month of June, but the nature of the soil may have had some influence; this is certainly the case for oats, the specimens of which are always found growing on sandy soil, while they do not occur on the plots where the earth is tenacious and clayey. On July 12th 1913, *Puccinia glumarum* ("Gulrosten") was first observed in the experimental field of the Ultuna Station. The types of wheat with dense compact ears such as "Renodlad Squatchhead", "Extra Square", "Sol", were immune; "Pudel" and the hybrids "Pudel - Västergötland" and also the "Weibulls Iduna" variety, were immune.

In positive cases the attack is limited to the leaves and very seldom to the ears. Distinguishing four degrees of infection we have the following data for the different types of wheat examined:

Type of Wheat	Degree of infection on the			Observations
	1st leaf	2nd leaf	and young	
"Västergötland" (dark ear variety)	1	1	4	
"Västergötland" (light ear variety)	2	3	4	
"Västergötland" (light ear variety)	2	3	4	
"01 257" (light ear variety)	1	1	4	
"01 254" (light ear variety)	1-2	2	4	
"01 255" (light ear variety)	1-2	3	4	
"01 256" (light ear variety)	2	2	4	
"01 258 Landt" (light ear variety)	1-2	2	3	
"01 259 Landt" (light ear variety)	1	2	3	
"01 260 Landt" ("brunt")	(1)	(1)	(1)	A few plants with a little <i>P. glumarum</i> .
"01 261 Landt" ("brunt")	0	0	0	
"01 262 Landt" (light ear variety)	1	1-2	2-3	

The entire or nearly entire immunity of the "Västergötland" ("brunt") dark ear variety, is worth noting.

P. graminis ("Swarttrosten") in 1913 appeared in Ultuna on July 14th; on barley, July 18th, and on oats, July 22nd. The damage was not much damaged; but such was not the case with oats, saved from Bönsta (Södermanland) which proved to be highly resistant.

Ustilago nuda ("Naket Kornst") attacked the following varieties of barley: "Hannchen" 0119, 0157, 0403 ("Chevalier II") and caused considerable damage to other varieties.

Ustilago avenae ("Häireflygsot") was found especially on the varieties "Zyri", "Borstlos Probstejr", "Guldregn" and "Leger" types.

Ustilago Tritici ("Hvetets flygsot") was noticed on a single variety of "Ultuna Landt" wheat.

375. **The Control of Cabbage Yellows (*Fusarium conglomerans* Wolt.) through Disease Resistance.** — JONES L. R. and GILMAN J. C. in *Annals of the Entomological Society of the University of Wisconsin, Research Bulletin 38*, pp. 1-10, 1945. Madison, Wisconsin, December, 1945.

Cabbage growing with the winter variety known as Hollander or Finnish Ball Head has assumed considerable proportions in various parts of Wisconsin. One of the worst enemies of this plant is *Fusarium conglomerans* Wollenw., which invades the roots either in the seed bed or soon after planting and by killing them and working up through the stem, causes the plant that it yellows, drops its lower leaves, stops growing, and finally dies or fails to head.

This parasite, probably introduced on seed into south-eastern Wisconsin some fifteen or more years ago, has rapidly spread in that section, continually invading new territory elsewhere, so that it seems destined to follow intensive cabbage culture wherever in the State the conditions are favourable. The disease is worst when a period of dry hot weather follows the transplanting, since a high soil temperature favours its development. Once introduced into the soil, it persists indefinitely, so that ordinary precautions are of little avail for its control. Various methods of treatment of seedlings and soil, including the trial of possible disinfectants and fungicides were without any practical effect. The most careful precautions are insufficient to preserve the plantations, for any contamination of seedling field with diseased cabbage refuse or with infected soil, blown with the wind or otherwise carried from a cabbage sick field, will disseminate the parasite in new places. The only practical method of control, therefore, lies in the possibility of securing disease resisting varieties of strains. The Volga and Houser varieties show the highest degree of resistance to yellows. Neither of these is, however, suited to commercial cultivation in Wisconsin. The standard winter varieties of the Hollander or Ball Head type are especially susceptible and the practical problem, therefore, lies in the securing of a *Fusarium*-resistant strain of this type. The method employed has been based on the observation that even in the worst infected fields in the autumn there are occasional sound heads. These have been selected, seed raised from them, this grown in turn on the sickest available and those plants which remain sound again saved as seed heads for seed growing. By repeated selection strains have been secured

and cabbage of the Hollander type which have proved in a high degree resistant against the *Fusarium*. In 1914, the best selected head of strain VIIa 25, gave a practically perfect stand, the heads averaging 100 pounds each, with a total yield of over 18 tons per acre, on the cabbage-sick soil, whereas the best commercial strain immediately selected showed over 80 per cent of yellows, the heads averaging about 50 pounds each, and yielding about 2 tons per acre.

The second generation selections grown in this way have proved even more resistant than the first. Thus the first generation of the selected strain VIIa showed at the end of the season of 1912, 96 per cent headed, and 80 per cent headed, whereas the second generation seed from the first selected from this crop in 1914, under a more severe test, averaged 95 per cent living and 94 per cent headed, and the best of this series of strains showed in turn 100 per cent living and 98 per cent headed. It is believed, therefore, that the degree of disease resistance, can, by selection, be at least maintained and probably somewhat increased. Such is being grown from some 2000 heads of these selected head strains which will permit distribution for planting on a commercial scale. This will be distributed under the name Wisconsin Hollander No. 8.

Varietal Resistance of Plums to Brown-Rot (*Sclerotinia cinerea*).—Vaucluse, W. D., in *Journal of Agricultural Research*, Vol. V, No. 9, pp. 308-308, 311, XXVII, XXX, Washington, D. C., 1915.

In the control of plant parasites a great deal of attention has recently been paid to the possibilities of producing resistant plants by breeding. In the plum-breeding plots of the Minnesota Fruit-breeding Station at St. Paul it is very noticeable that the fruit of certain seedling varieties of plums (*Prunus* spp.) appears to rot much more readily than that of others. This is due to the attacks of the brown-rot fungus, *Sclerotinia cinerea* Wor. On the strength of these facts the writer has carried out a series of researches on the resistance of plums to the brown rot fungus. The following varieties were used for these experiments:

1. B \times W = *P. triflora* (Burbank) \times *P. americana mollis* (Wald). The Burbank is a medium thick-skinned variety which becomes soft when ripe and is rather susceptible to the brown rot. Wald has a thick tough skin and is not affected to any great extent by the rot in the fruit.

2. A \times W = *P. triflora* (Abundance) \times *P. americana mollis* (Wald). Abundance is less subject to the attacks of the brown-rot than Burbank.

3. Etopa = *P. besseyi* (Sand cherry) \times *P. triflora* (Sultan) and Etapa = *P. triflora* (Red June) \times *P. americana* (De Sota); thin skinned varieties susceptible to rot.

4. S. D. Nos. 1, 2 and 3 = all appear to be sand cherry hybrids; S. D. No. 1 is a thin skinned variety and rotted badly on the trees when sprayed with Bordeaux mixture; S. D. Nos. 2 and 3 were thicker skinned firm varieties and did not rot after one spraying.

5. Compass = $\frac{1}{2}$ *besseyi* \times *P. americana* (Hansen), is a thin

skinned variety which becomes soft on ripening and is susceptible to brown-rot:

- 6) Reagan is *P. hortulana* (Wayland) s. *P. americana* group, is thick-skinned, very firm when ripe, and is very resistant to brown-rot.
- 7) Hammer is *P. hortulana* minor s. *P. americana* group.
- 8) Osceola and Harrison are varieties of *P. americana*.
- 9) Manitoba No. 1 is probably a variety of *P. nigra*.

The brown rot fungus in Minnesota which produces the disease is identical with that found in other parts of the United States, *Sclerotinia cerevia* in Europe. Though the infection may be introduced through wounds and lesions of the skin, it may also at any time pass through the uninjured skin during the development of the plum. Brown rot is essentially a ripe rot, affecting the plums most noticeably soon as they begin to soften slightly as result of ripening. This may be due to the circumstance that at the time of ripening the temperature is more elevated and therefore more favourable to the development of the disease. When the ripening takes place later towards fall, and the temperature is lower, the presence of the brown rot is less frequent. The writer has experimented by infecting the fruit with a water containing spores of *Sclerotinia*, or merely by contact with the substance.

The rotting took with greater intensity and rapidity in the thinned and tender-fleshed varieties. Thus the most susceptible varieties (Compass, s. Etapa, s. Wakapa, s. Okiya, s. Sand Cherry, *P. americana* S. D. No. 1). The thick-skinned firm-fleshed varieties, (Ida, *P. americana* No. 1, s. B. s. W. 15, s. S. D. Nos. 2 and 3), are more resistant. Not only the degree of skin-thickness, but the presence of layers of cells, and the production of parenchymatous plugs which fill the cavity through which the hyphae are unable to pierce, have a great influence on the penetration of the fungus. In the resistant varieties (B. s. W. 15, and A. s. W. 9) the filling of the stomatal cavity is common. That the complete plugging of the stomata is a factor of resistance is shown by the fact that many instances were noticed in these stomata were covered by germinating spores with no effect on infection.

The hyphae of *Sclerotinia* did not produce a cellular-splitting agent which has the power of dissolving the cell walls, but they secrete a substance which splits out the middle lamella slightly in advance of their penetration through the tissue. Eventually the middle lamella is completely dissolved, and the cells in the rotted area being left entirely free, the other die. The killing of the host cells seems due principally to the alteration of the osmotic relations of the cells as a result of the absence of the middle lamella and to much of the liquid contents of the cells being withdrawn by the fungus to be used in its development.

The nature of the substance secreted is not at all clear. Attempts were made to isolate the enzyme from a culture of the fungus with no success.

It appears to be almost certain that the chemical composition of the cell wall varies a good deal in the different varieties of fruit; this may explain the different degree of resistance.

A great deal of attention is being given to the relation between chemical changes within the host cell and resistance. Cook and Taubenhaus (1920) show that tannin, a very common product in plants, was present in varying degrees to many fungi. If, as is generally supposed, the galls appear on the ripening of the fruit, the greater susceptibility of apples to disease on ripening might thus be explained; but since the galls do not come into direct contact with the fungus hyphae which are generally always intercellular, the above hypothesis does not appear satisfactory. The doubt as to the relationship between gallotannic acid and resistance increases by reference to the following table in which results of the determinations made by the writer are given:

Apple variety	Condition	Date of ripening	Percentage of tannin in pulp	Percentage of tannin in dry matter	Percentage of dry matter	Relative susceptibility
Empire	Ripe	Aug. 1	2.087	15.081	13.84	+
St. Cherry	do	—	.234	1.483	15.75	+
Pinetop	do	—	.338	2.388	14.17	+
Golden Wonder	Turning	Aug. 17	.302	3.307	10.75	+
Golden Wonder	Green	Aug. 15	.183	4.220	11.12	++
Golden Wonder	do	—	.482	3.118	14.10	++ +
Golden Wonder	Turning	Aug. 17	.733	4.618	15.87	++ +
Golden Wonder	Green	do	.185	1.516	12.20	++ +
Golden Wonder	do	Aug. 16	.773	5.777	13.48	++ +
Golden Wonder	do	Sept. 2	1.131	9.520	11.88	++ +
Golden Wonder	do	—	.165	3.873	17.17	++

++ = ++

The rot caused by *S. cinerea* is a firm-rot due to the mechanical support of the hyphae which completely fill the intercellular spaces left by the rupture of the host cell walls. *Penicillium expansum* produces a soft-rot because of the fact that few hyphae are produced, and therefore, little mechanical support is given to the rotted tissue, which, as a consequence, collapses as the rot progresses.

DISEASES
OF VARIOUS
CROPS

357 - Effect of Attacks by *Cercospora beticola* on the Composition of Beets (1). — SAILLARD, EMILIE, in *Comptes rendus des séances de l'Académie*, Tome 162, N. 1, pp. 47-49, Paris, 3rd January 1916.

In 1915 the French sugar beet crop was attacked by *Cercospora beticola* Sacc. The damage was most serious in the districts of Calvados, Eure-et-Loire, in parts of Seine-et-Marne, though the boundaries of the cultivated region also suffered, e.g. Seine-Inférieure, Eure, Loiret. The harvest was bad both in quantity and quality, although the percentage of sugar was, with a few exceptions, more or less equal to that of the previous year. Generally speaking, the juices were less pure and contained more salts; the juices and alkaline sirups lost the greater part of their weight in the process of heating for refinement and evaporation; finally, per cent. of roots the quantity of sugar in bags obtained was less, and the quantity of molasses greater than usual. Similar anomalies were noted in the beets of 1911, an exceptionally dry year. The writer has traced the cause in the 1915 crop by determining the sugar content, total of albuminoids, amides, and ammonia compounds, noxious nitrogenous parts of sugar and comparing the results with previous years. The following results were obtained:

1) The 1915 beets contained per 100 parts of sugar larger quantities of total nitrogen, amide nitrogen, ammonia compounds, and noxious nitrogen, than those of the previous years; and larger quantities even than those of the exceptionally dry year 1911. Like those of that year they contained a great deal of their alkali and yielded a very high proportion of molasses.

2) The results of the determinations of sugar by hydrolytic version and by enzyme-inversion are in agreement, but inferior (as 0.4 %) to those obtained by water digestion. There existed, therefore, in these roots dextro-rotatory substances differing from saccharose could not be precipitated by means of lead acetate.

The writer has found that these polarising substances disappear the greater part (as active substances) during the industrial manipulation, so that in the molasses practically no amide or ammoniacal nitrogen remains. The disappearance of these dextro-rotatory substances is therefore related to the elimination of the amide and ammoniacal nitrogen and entails a loss of polarisation. On the other hand, separate tests have shown that the aspartic acid and the glutamic acid heated in an alkaline solution gradually lose their rotatory power and liberate ammonia.

358 Club-root (*Plasmodiophora brassicae*) in New Zealand. — COCHRAN, in *The Journal of Agriculture*, Vol. XI, No. 3, pp. 197-203, Fig. 13, Wellington, 1915.

During 1915 club-root has been extremely prevalent in various parts of New Zealand.

Club-root attacks only plants belonging to the turnip family (*fritate*) and in New Zealand has been reported as occurring on the following cultivated members of the group: cabbage, cauliflower, Brussels sprouts, rape, mustard, swede, turnip, soft turnip, radish, and wallflower.

(1) See *ibid.* Nov., 1915, N. 1216.

is also found on the roots of certain weeds belonging to the same family amongst which may be especially mentioned: Shepherd's purse (*Barbarea-pastoris*), wild turnip (*Brassica campestris*), American cress (*Barbarea-princeps*), hedge-mustard (*Sisymbrium officinale*), and pepper-wort (*Thlaspi-andersalei*).

Club-root is widely distributed, and has been found in all classes of soil in New Zealand. It is, however, most prevalent on the west coast of the North Island, and especially in the Taranaki and north Wellington districts. In the South Island it is comparatively rare as a field crop disease, but is often abundant in garden soils. Those districts in which the underlying rock is largely composed of limestone generally are comparatively free from the disease, but at certain times had outbreaks occur in the cities. In such cases it is probable that although the subsoil is of a calcareous nature the upper layers are deficient in lime, owing to having been leached out in the ordinary processes of weathering. The best conditions are far more favourable for the development of club-root in those of neutral or alkaline soils. A very noticeable feature connected to club-root is the fact that its prevalence as a serious disease does not take place in Europe until the modern use of fertilizers of an acid nature. The following are the most advisable means of control:

- 1) Abundant dressings of calcium carbonate (ground limestone) on the case of badly affected land, as much as 7 tons per acre, to be done in autumn previous to the sowing of the seed.
- 2) Leguminous crops should be grown on affected land.
- 3) Preference should be given to the swede varieties which are more resistant; that is: Superlative, Magnum Bonum, John Bull, Elephant, and Tyson King.

Pathogenicity and Identity of *Sclerotinia libertiana* and *Scl. smilacina* on Ginseng (*Panax quinquefolia*). ROSE-NIXON J. (Mycologist, Bureau of Plant Industry in *Journal of Agricultural Research* Vol. V, No. 7, pp. 291-297, 1913, Pl. XXVIII XXIX, Washington, D. C., 1913).

For a number of years two species of *Sclerotinia* (*Scl. libertiana* and *Scl. smilacina*) have been recognized as probable causes of the rotting of ginseng roots (*Panax quinquefolia*) but the pathogenicity and identity of each have not been proved by inoculation experiments.

The writer has contributed a series of researches and experiments to the solution of this problem, the results of which may be summarised as follows: 1) The species of *Sclerotinia* causing the white-rot of ginseng roots is identical with the *Sclerotinia libertiana* Fuckel occurring on lettuce, celery, and other hosts. 2) The black-rot is due, on the contrary, to *Scl. smilacina* Durand, identical with *Scl. panacis* Rankh; inoculations with strains of *Sclerotinia* from ginseng on *Smilacina racemosa* having given the same results.

360 - **Bamboo Smut Fungus (*Ustilago shiraiana* Henn) in Cuba.**

DANIEL in *Modern Cuba (Cuba Moderna)*, Vol. 3 (7), No. 11, pp. 35-41, November, 1915.

In the spring of 1910 one of the Japanese bamboos at the Plant Introduction Garden was found to be attacked by a smut, identified as *Ustilago shiraiana* Henn. The disease has since been spreading in other parts of the island, causing damages serious enough to call for immediate attention.

The disease occurs first on the younger and growing portions of the branches, which appear somewhat swollen but show no external signs of smut. The growth of such diseased branches is arrested and, as the external covering of the buds fall away, the sooty portions appear. At a certain stage in the development of the disease a witch's broom condition is apparent. This disease is extremely serious and of the greatest economic importance as it may lead to the death of the entire bamboo plant.

The wind is the principal factor in the distribution of the disease, as branches of bamboo growing outside of the forest have been noticed to be much more than smutted the inner branches. The disease occurs on *Phyllostachys puberula* Munro, and *P. bambusoides* Sieb. and Zucc. and on *Sasa ramosa* Makino and Shibata, and *Arundinaria sinensis* Makino and Shibata, in Japan.

Burning of all diseased plants is the only sure means of eradicating the disease. Spraying with Bordeaux mixture when the spring buds begin to develop has been suggested, but is a doubtful means of control.

361 - **Leaf-spot Disease of Lime (*Gloeosporium tiliacolum*) in England.**

SALMON L. S. and WORMOLD H. in *The Gardener's Chronicle*, Vol. LXIII, pp. 133-134, Figs. 64-65, London, 1915.

Gloeosporium tiliacolum Allescher was first noticed on the leaves of a large lime tree in a garden at Bearstead, near Maidstone, Kent. A full account is given of the disease caused by this fungus according to Herbert's observations in Germany.

WEEDS AND PARASITIC FLOWERING PLANTS.

362 - **Comparative Researches on the Dimensions of the Seeds of Clover and Dandelion.**

See No. 200 of this Bulletin.

363 - **Dandelion (*Taraxacum officinale*) in New Zealand.**

See No. 200 of this Bulletin.

The writer, continuing the enumeration of weeds in New Zealand, gives a general description of the dandelion (*Taraxacum officinale*).

This seed is widely distributed in both Islands of New Zealand, and is particularly common on roadsides and such waste places, and is also

(1) See B. Dec. 1915, No. 1352.

growing amongst grass, even when the latter is tall enough to cover the ground.

The achenes of dandelion are occasionally found as impurities in some dandelion seeds.

Californian Thistle Rust (*Puccinia suaveolens*) as a Check on the Spread of Californian Thistle (*Cnicus arvensis*) (1) COCKAYNE A. H. in the *Journal of Agriculture*, Vol. XI, No. 1, pp. 300-302, Wellington, 1913.

In some years past it has been noticed that the Californian thistle-*Puccinia suaveolens*) has increased considerably amongst these thistles in many parts of New Zealand. Its effect in reducing the vigour and rapid development of the weed has been quite marked.

For the rust to become an adequate means of control it is necessary to increase infection considerably beyond that occurring naturally. In the attack is generally limited to a few shoots, and the plant may not lose vigour and develop normally.

A series of experiments has been carried out to discover a practical method for securing a rapid and complete infection. The result has been to show that only the teleutospores produce a permanent type of mycelium, while the mycelium produced by the uredospores is temporary.

Teleutospores are therefore the best means for artificial infection.

Positive results were obtained by the following method: a quantity of seed shoots in which the uredopustules are emitting spores should be placed in water for about half an hour and the material constantly agitated so as to release the spores into the water. The water containing the spores should then be sprayed on young healthy thistles. After about fifteen days the small brown second-generation uredopustules will have commenced to develop. In the autumn, just before the leaves begin to wither away, the development of teleutospores will have been about completed, and the affected leaves should be collected, dried and kept till the early spring. The leaves should then be crushed up and soaked in water in order to liberate the spores, after which the water containing the spores should be sprayed on to the young growth of the thistles; in this manner the infection will be violent and will spread rapidly.

Queensland Government Enquiry into Means of Controlling Prickly-Pear.

By GEORGE HARVEY T. and TRYON HENRY in *Report of the Prickly Pear Travelling Committee*, pp. November 1, 1912; April 30, 1913, 131 pp., 60 Figs., Brisbane, 1913.

In September 1912 the Government of Queensland appointed a Commission to visit countries in which prickly-pears are indigenous or have become naturalised, for the purpose of ascertaining: 1) If there are in such countries any natural enemies of the prickly pear that may be utilised for the destruction of the plant in Queensland; 2) The possibility of utilising the prickly pear for commercial purposes.

Investigations were made in the following countries. Queensland, New South Wales, Java, Singapore, Malay States, Penang, Ceylon, In-

dia, East coast of Africa, South Africa, Canary Islands, Europe, Mediterranean area (England, Germany, Italy, Spain, Barbary, Malta, Syria), United States of America, Mexico, Central America, India, South America (Colombia, Brazil, Argentina, Chile, Falkland Islands).

The results of the investigations are given separately for each country visited. The following is a summary of the principal facts.

The prickly pears naturalised in Queensland are: the common pear *Opuntia inermis* D. C., var.; the spiny pest pear *O. dillenii* (that just named: *O. monacantha* Haw.; *O. aurantiaca* Gillies; *O. bosa* S. D.; *Nopalea cochineolifera*, Linn.; *O. imbricata* Haw.; *Opuntia* *O. megacantha* S. D. or *O. chucena*, Griff. and another species, not identified, called the "yellow fruiting Mexican pear"; *O. nigricans* and *O. lea dejecta*, S. D. New South Wales possesses: *O. inermis* D. C.; *O. nigricans*, Haw.; *O. monacantha* Haw.; *O. ficus indica*, *O. microdon* and *O. monacantha* occurs naturalised in Victoria and South Australia. The spiny pest pear of Queensland is also reported from the latter State.

The species naturalised in several other countries visited are:

- in Ceylon: *O. dillenii*; *O. monacantha*;
- in India: *O. dillenii*; *O. nigricans*; *O. stricta*, *O. monacantha*;
- in South Africa: a variety of *O. decumana*; *O. aurantiaca*; *O. monacantha* and several others;
- in the Canary Islands: certain species are cultivated as hosts for the true cochineal insect *Coccus caffi*;
- in the Mediterranean region: *O. ficus indica*; *O. amygdali*; *O. stricta*; *O. inermis*; *O. nana*.

In the cactus regions of the United States and Mexico, there are several species of so called "wood-rats" belonging to the genus *Mastomys* which at times cause great havoc to prickly pear, utilising it as food to an extent sometimes as to exterminate it in places. However, since they, as well as various other rodents, are not restricted in their dietary to succulent plants, the writers do not advise their introduction to Queensland.

In Ceylon, India and South Africa, *O. monacantha* is attacked by a wild cochineal insect, *Coccus indicus* which, in the two first named countries has caused the almost complete extermination of the host plant. This cochineal does not attack in India *O. dillenii* and *O. nigricans*. In Ceylon, *O. dillenii*.

In South Africa another wild cochineal insect (*Coccus confusus* (Sis), attacks *O. monacantha*, causing serious havoc but not completely destroying the plant.

The most important insect enemies of cacti found in America belong to the orders of Coleoptera, Lepidoptera, Hemiptera and Diptera.

In regard to the Coleoptera the various species of the genus *Meloida* are widely distributed in the drier parts of the United States and Mexico; those of the genus *Ctenopactus* in Southern California and the adjacent regions; whilst the genus *Gierstaekeria* has only one species injurious to prickly-pear, *G. hubbardi*, in Florida. The adult of *Meloida*

Scaphiophagus is a large black wingless longicorn beetle, which feeds mostly on the young segments of the host plant, while the larva is generally living in tunnels hollowed out by it in the stems and joints. The lepidopterous enemies comprise a number of cactus moth borers known to the Phycitidae (N. and S. America and W. Indies) as well as others, such as *Mimorista* and *Marmara* (especially in N. America and W. Indies). The caterpillars belonging to the genus *Melitara* and *Zophodia* grow within the joints of the plant, and cause great destruction, partly on account of their eating out the tissues and partly on account of the growth which the attacked segments become invaded by secondary pests such as bacteria, fungi and scavenging flies. *Mimorista* occurs also in the West Indies, Brazil and Mexico, and causes a great destruction of young segments of prickly-pear. The tiny caterpillar of *Marmara* "leaf-miner" and causes little injury as a rule, though secondary pests may be serious.

Amongst the Hemiptera are certain prickly-pear enemies, especially various species of wild cochineal insects, and the members of the genera *Chelinidea* and *Narnia*. These all more or less injure the plants. In India, South Africa and Mexico they cause more serious injuries and may result in the death of the plant.

The chief Diptera which infest prickly-pear are certain gall midges known to the genera *Homida* and *Asphondylia*. The former produces galls under the areoles, and these may become the seat of secondary infestation. The species of *Asphondylia* which infest *Opuntias*, live during larval stage within the fruit or the flower bud, and either destroy the fruit or else cause a proliferation.

After pointing out that the insects enumerated are far from being the worst of the insects injurious to *Opuntia*, and that especially in Mexico and South America additional natural enemies quite as injurious may exist and be utilised, the writers recommend that, for the time being, the following insects be introduced into Queensland: *Monilema* spp., *Cactococcus palmeri*; *Gerstaeckeria hubbardi*; *Melitara* spp.; *Mimorista flavicincta*; *Chelinidea* spp., *Narnia* spp., the wild cochineal insects; *Homida opuntiae* and *Asphondylia opuntiae*, from the United States; *Zophodia factorum* and its ally, the "Mendoza moth borer", from the Argentine Republic.

Certain destructive wild cochineal insects have already been introduced into Queensland from Ceylon and South Africa. These have become established, and have maintained their character for destructiveness at the Prickly-Pear Experimental Station, Dulacca. In their native country these insects are more or less controlled by predators and parasites, and therefore cannot exercise their full influence. It is consequently a matter of great importance that, before admission into Queensland, parasites should have been eliminated. A careful superintendence is therefore necessary. This would involve the providing of a suitable insectary under the control of an entomological staff with experience in this kind of parasitological work, as well as in the technical

details of receiving, multiplying and distributing such insects at the moment of leaving their original home, and at their arrival in Queensland.

The insects recommended for being introduced into Queensland limit their destructive action to the Cactaceae; this statement is true as regards the cochineal insects and is based on recorded observations and experiences of upwards of a hundred years standing and extending over many different countries. There are, however, a good number of Cactus insects which do not feed only on prickly-pear but attack useful and cultivated plants. Amongst these may be mentioned the Fly *Ceratitis capitata*, Wied; the Mealy Bugs *Pseudococcus obscurus*, *Rhizococcus multi-spinosus*, Kuhl.; the Cuban Cactus Coecid *Pseudococcus* sp., the Plant Bug *Stylopodia picta*, Uhler; the blossom-injuring *Trichochrous texanus*, Le Conte; the Calandrid root-borers *Calandria* spp.; the Cactus Aphid *A. gossypii*; the Cactus Red Spider *Tetranychus* sp., etc.

As regards maladies caused by parasitic agency, the writers know of only one disease to be of sufficient value to warrant its introduction into Queensland. This is the "anthracnose", "shot hole", or "hole" malady, caused by a fungus *Glucosporium lunatum* E. and E. One of the effects of this organism has but little effect on the plant, but under conditions of high temperature and high humidity it causes a considerable and rapid destruction of young segments. In the Argentine Republic there is a serious disease "the white rot" caused by a fungus *Sclerotium opuntiarum*, Speg., which brings about the destruction of joint stems of various cacti. As the habits of this parasite are not sufficiently known, the writers do not, for the present, recommend its introduction. There are other parasitic diseases known in the West Indies, United States of America, Mexico, and the Mediterranean region, but their effects are not of sufficient importance in controlling the spread of prickly-pear.

As a means of destruction by overgrowth, it has been suggested that the introduction of a certain fodder grass from Brazil might be of service, as on account of its rapid growth it would probably choke the prickly-pear. In a northern portion of South America a rapidly growing climber of enormous size is used. The twining branches form a network enclosing the prickly-pear clump around which the seeds of the plant have been sown, and then the stems are cut. After the climber has become somewhat dry, it is set alight and the prickly pear becomes seriously scorched. A repetition would probably destroy the latter.

As regards destruction by chemical means, the writers have seen no method superior to those already in vogue in Queensland.

As a control to the spread of *Opuntia*, utilisation might prove of importance. The writers point out that the fruit of certain species of prickly-pear is used as a human food in many parts of the world, but more especially in Mexico and the Mediterranean littoral. Though this method would not be of much value in compassing destruction of *Opuntias* in Australia,

It is suggested that an abundant source of nutritious food, availed of in other countries, may have been entirely lost sight of here.

In India, South Africa, the Mediterranean region, America, and also elsewhere, the stems and joints of prickly-pear are mostly used as fodder, especially in conjunction with rations of more concentrated foods. The utilisation of *Opuntia* is, however, as yet in a more or less experimental stage. The writers are of the opinion that it is possible to reduce the very extensive area occupied in Australia by prickly-pear by using it largely as fodder, especially as the joints and stems of *Opuntia* seem to augment the quantity of milk produced; they suggest, however, to cut the plants and take away the fruit so as to avoid contamination by means of the seeds in the excreta of the cattle.

Prickly-pear has been used to considerable advantage as a soil fertilizer, especially in India. It enriches the soil with humus and potash. The plant has been used for alcohol production in Italy and Spain, where the distillation was a commercial success until the imposition of an excise duty rendered the concern unprofitable. The introduction of this industry in Australia would probably lower the cost of eradication.

The utilisation of the fibre as a raw material for the manufacture of paper and board has not as yet given any good results, according to the investigations carried out by experts and by the Imperial Institute, London, especially on account of the high cost of production. Further experiments might, however, be made in Queensland, where the fibre could be secured without much cost in the process of clearing the land. It is suggested that the mucilage might serve as a glaze for cheap cotton stuffs. In fact it has been used as an addition to white wash and to a kind of stucco employed in the decoration of edifices, which is said to have a fine texture and to be capable of receiving a fine polish.

According to the writers, the entire plants of prickly-pear including the root system, might be an important source for the manufacture of oxalic acid, as they contain a large amount of oxalate of lime in a crystallised form.

The colouring matter of the fruit may be extracted and used for colouring sweets, beverages and various foodstuffs.

Kainit as a Means of Destroying Weeds (14).—WITTE HERNERID, in *Swertiges Utskrift af Svenska Tidskrift*, Year XXV, Part 4, pp. 176-181, Stockholm, 1915.

In his experiments for destroying weeds, the writer has made use of calcium cyanamide, a mixture of kainit and calcium cyanamide, and sulphate of iron. In nearly all cases the sulphate of iron (20-25 % solution) and the calcium cyanamide have given results much inferior to those given by kainit. Only in the case of *Papaver* sp. calcium cyanamide was preferred. Sulphate of iron has no effect whatever on *Centaurea* sp. The action of kainit is heightened by the addition of a certain quantity of calcium cyanamide. The weeds most susceptible to kainit are *Urtica arvensis*, *Raphanus*, *Raphanistrum*, *Polygonum*, *Convolvulus*,

Anthemis arvensis, *Veronica arvensis*, *Stellaria media*, *Urtica urens*, *Urtica vulgaris*, *Centaurea Cyanus*. The weeds more resistant to the action of kainit are: *Spergula arvensis*, *Sonchus*, and *Papaver Rhoeas*.

Kainit works directly by means of plasmolysis, absorbing it from the cells with which it comes in contact and causing the gradual withering of the plant. In the application of kainit the rules to be followed are:

1) 1,340 lbs. of powdered kainit per acre to be evenly distributed over the soil. If *Sinapis arvensis* and *Raphanus Raphanistrum* are very abundant, it will be best to apply first 1,785 lbs. of kainit and immediately 90 lbs. of calcium cyanamide.

2) The applications should be made when the weather is warm and in the early morning when the plants are still wet with dew.

3) For winter wheat the applications should be made in February and March, for spring wheat at the time of sprouting.

INJURIOUS INSECTS AND OTHER LOWER ANIMALS

367 - *Ooencyrtus pacificus*, a New Egg Parasite from Fiji. — WATERS, in *Bulletin of Entomological Research*, Vol. VI, Part 3, pp. 507-510, 1 Fig. 1913.

The writer describes as a new species under the name of *Ooencyrtus pacificus* a Hymenopter bred from the eggs of the Bean Bug (*Delonotus platys pacificus* Dull.), at Rarawai, Viti Levu.

368 - *Chilocorus hipustulatus* and *Exochomus quadripustulatus*, Recently Introduced from Italy into California as Natural Control of Injurious Scale Insects. — SMITH HARRY S., in *Monthly Bulletin of State Commission of Horticulture*, Vol. IV, No. 11, pp. 523-535, Plz. 103-107, Sacramento, California, 1915.

The genera *Chilocorus* and *Exochomus* are probably the most efficient of all ladybirds preying upon Coccidae.

The writer mentions the introduction of two species, *C. hipustulatus* (L.) and *E. quadripustulatus* (L.), from Italy into California during the summer of 1915.

C. hipustulatus inhabits the whole of Europe, and also occurs in northern Asia. In Italy its principal hosts are *Philippa oleae*, *Pollinia pili*, *Aspidiotus betulae*, *Diaspis pentagona* etc. The female deposits its egg under the shields of *Saissetia oleae* or of the *Diaspinæ*; the larvae, which hatch in four to eight days, are extremely voracious, and during their life period of existence are capable of devouring several thousand eggs of scale insects. Approximately seven hundred specimens of this species were introduced at Fair Oaks, Sacramento County, during the period from July 10 to September 17th. They were placed in an orchard consisting of lemon orange and olive trees, the citrus being infested with *Coccus citricola* Comst. and the olives with *Saissetia oleae* Bern.

Approximately three hundred and fifty individuals of *E. quadripustulatus* were placed in the same orchard on September 17th. This species occurs throughout Europe.

***Paraleptomastix abnormis*, a New Chalcidoid Parasite of the Citrus Mealy Bug, *Pseudococcus citri*, Introduced from Italy into California.** — SMITH

— in *The Monthly Bulletin of State Commission of Horticulture*, Vol. IV, No. 11, 1914, p. 27, Fig. 108. Sacramento, California, 1913.

Paraleptomastix abnormis Girault, was introduced from Palermo into California during the summer of 1914, as control of *Pseudococcus citri*. It has been bred extensively in confinement and widely distributed in the following localities: Sierra Madre, Upland, Alhambra, Monrovia, San Gabriel, Fresno, Marysville, Riverside, San Diego County, Sweetwater, San Francisco, San Mateo County, Santa Paula, and Sacramento. Colonies were also furnished to the Florida Experiment Station at Gresham, and to the Board of Agriculture and Forestry, Honolulu, Hawaii. The results of the field investigations were very gratifying, the parasites have been found breeding under natural conditions in the field at Alhambra. The same may be said of San Diego where the parasite has shown to be resistant to hydrocyanic acid gas in its earlier stages of development. It has been also observed that where the Sicilian parasite is breeding and where its predators are also working, the predators will devour every parasitized mealy bug, but always leave the individuals which are parasitized by the Sicilian parasite after the pupa is formed.

It is proposed to increase the distribution of these parasites very much.

Woodpeckers and their Relation to Forestry in the British Isles. — COURTNEY, H., in *The Journal of the Board of Agriculture*, Vol. XXII, No. 8, pp. 789-791, 1913, p. 785.

Woodpeckers are without doubt the most useful birds for destroying insects injurious to forest timber.

Numerous observations made by the writer in the open fully confirm the following two facts: 1) Sound trees are seldom, if ever, attacked, and large numbers of insects are destroyed by woodpeckers.

There are three species of woodpeckers in the British Isles, viz., the Great Spotted Woodpecker, *Dendrocopos major* (Linn.); the Lesser Spotted Woodpecker, *Dendrocopos minor* (Linn.); and the Green Woodpecker, *Geopelia viridis* (Linn.). The latter is by far the commonest, and the majority of the observations have been made on this species. Examination of the contents shows that fully 75 per cent of the food consists of insects, the principal species being: Osier Weevil (*Cryptorhynchus abietis* Linn.); Pine Weevil (*Hyllobius abietis*, Fabr.); Bark Beetle (various species of *Tomicus*); Pine Beetle (*Mycophylus piniperda*, Linn.); Ash Bark Beetle (*Hylesinus fraxini*, Pz.); Elm Bark Beetle (*Scolytus destructor*, Linn.); Black Pine Beetle (*Hylastis ater*, Payk.); Small Poplar Longicorn Beetle (*Cerambyx populnea*, Linn.); Common Longicorn (*Rhagium bifasciatum*, Linn.); Rhinoceros Beetle (*Sinodendron cylindricum*, Fabr.); and Short-nosed Beetle (*Xyleborus dispar*, F.).

The larvae of the Pine-shoot Tortrix Moth (*Retinia budiana*, Schiff.); Birch Clearwing Moth (*Sesia caliciformis*); and the Wood Leopard Moth (*Zeraca aestivalis*, Linn.) have also occurred.

Of the remaining 25 per cent. of food quite 20 per cent. consists of ladybird beetles, the further 5 per cent. being made up of 1 ladybird beetle and insect remains not identifiable.

371. **The Effect of Various Dressings on Pruning Wounds of Fruit Trees**
of this Bulletin

372. **A New Thrips (*Diarthothrips coffeae*) Damaging Coffee in British Africa.** WILLIAMS C. B. in *Bulletin of Entomological Research*, Vol. 14, pp. 269-271, Fig. 1, London, 1918.

The writer describes, under the name of *Diarthothrips coffeae*, a new genus and new species, a Thrips causing serious damage to the coffee in several districts of British East Africa.

373. ***Phaedon cochleariae* and Other Insects Injurious to the Horse-radish (*Nasturtium Almoracia* — *Cochlearia Armoracia*), in Sweden.** TULLGREN ALB. in *Meddelande Nr. 113 från Centralanstalten för försöks- och förbrukningsvetenskap, Jordbruks-måttet, Lids-måttiska Avdelningen Nr. 22*, pp. 1-15, Figs. 1-5, 1918.

In 1913 *Phaedon cochleariae* Fabr. "Senapsbaggen" caused serious damage to the plantations of horse-radish in the vicinity of Enköping. The larvae of this insect eat away the margin of the leaves, sometimes eating nothing but the veins. The perfect insects, which generally galliate under surface of the leaves, damage them in a similar manner.

The following plants, though in a lesser degree, are also attacked: *Brassica Napobrassica* L. and *B. Rapa* L., also many wild cruciferous species such as *Nasturtium officinale* R. Br. and the species of the genera *Pis* and *Cardamine*, *Cochlearia officinalis* etc.

The distribution of this insect in Sweden is not as yet completely known. Up to the present it has been reported, besides from Enköping, from N. (1891-1892), Morby and Margretelund (1892). In other countries of Sweden, from Bohemia (1861), England (1880 and 1890) and B. (1908). The following means of control are advised:

- 1) All leaves and vegetable residues on which the insect hibernates to be gathered in the autumn and destroyed.
- 2) All weeds and bushes around the horse-radish plantations to be rooted up and destroyed.
- 3) As soon as the insect is seen at the beginning of summer, a copious treatment to be given of arsenate of copper, and lime (200 gms. of arsenate and 400 gms. of lime in one hectolitre of water) combined with soda (20 gms. per hl. of water); this operation to be repeated once or twice during the summer when the larvae of the second generation begin to appear.
- 4) Arsenate of copper to be replaced when possible with arsenate of lead (300-400 gms. of arsenate of lead in 1 hl. of water).

During the study of this species other insects have been discovered that live on the horse-radish damaging it to a minor extent: *Phyllotreta pennis* Curt.; *Pisica rapae* L.; *Pionica forficatis* L.; *Meligethes brassicae* S. G.; *Phyllotreta nemorum* L.; *Eurydema cleracea* L. and *Philaenus spumarius* L.

Eggs of an Insect of the Order *Odonata* Occurring on Pear-tree Branches.

PARROT, K. L. in *Centralblatt für Bakteriologie, Parasitenkunde und Infektionskrankheiten*, Part 2, Vol. 44, N. 21-25, pp. 702-707, Jena, 12th January 1916.

On April 15th, the Station for the protection of plants in Vienna received from Trent (Tyrol) a certain number of pear-tree branches, about the diameter of a pencil, the soft cortex of which showed a number of small nodosities due to the punctures of an insect. The longitudinal axis of the nodosities was perpendicular to that of the branches. The nodosities had almost always a central wound in which the eggs of an insect were deposited in varying numbers. The wound was the size of a pin's point and was often covered over by the epidermis. The number of eggs in each wound varied from two to four and even more. The eggs were deposited in the superficial layers of the vegetable tissue to which they adhered closely.

The tissue showed no disease except just round the wound. The length of the eggs was between 1.43-1.53 mm., and the breadth between 0.4-0.49 mm., they were of a yellowish-white colour turning to dark-brown at the extremities.

The insects bred from these eggs have been identified as belonging to the order *Odonata*, suborder *Zygoptera*, of which the family of the *Agriionidae* is the best known. The writer believes that the insect in question belongs to the last mentioned family.

The importance of this insect as regards the pear-tree is not yet known, as it deposits its eggs only in the superficial tissue of the epidermis, it is most probably not injurious to the tree, the wound produced by the puncture of the insect may, however, favour the entrance of certain fungoid diseases.

Cherry and Hawthorn Sawfly Leaf Miner (*Profenusa collaris* n. g. and n. sp.) Injurious to Cherry and Hawthorn in North America.

PARROT, K. L. in *Journal of Agricultural Research* Vol. V, No. 12, pp. 519-528, Pl. 11, Washington, D. C., 1915.

In June 1910, a leaf miner attacking cherry (*Prunus* spp.) was reported to the Experiment Station Geneva, N. Y. Some specimens were forwarded to Dr. A. D. MAC GILLIVRAY, who reported that the insect represented a new species, the type of a new genus, and should be recorded as *Profenusa collaris*. The information was also given that it had been reared from the leaf-miner (*Craluegus* spp.).

According to present knowledge, the host plants of the sawfly leaf miner are the cherry and the hawthorn. Of the cherries, it has so far largely limited its attacks to the English Morello variety. It is not commonly observed with the Montmorency or Early Richmond, which indicate that its presence on these varieties is accidental and occurs when they are grown in proximity to the English Morello. The extreme partiality of the sawfly to cherry and the susceptibility of one fruit while other fruits are apparently unattractive or resistant, are interesting facts. Around Europe the sawfly leaf miner is most common in the foliage of an unidentified hawthorn belonging to the *Medioximae* group, and is especially des-

destructive to hawthorns of the *crus-galli* group and to *C. nitida*, *C. canadensis*, *C. rotundifolia* and *C. genesensis*; the larvae devour all the portions of the leaves, only the epidermis remaining, which dries up and falls off. Some species of hawthorn that are generally exempt from attacks of sawflies are *C. pedicellata* and *C. punctata*.

As a cherry pest this insect is found about Geneva in western New York and about Germantown, while it does not occur in the intermediate localities although the cherry is extensively grown there.

As a pest of hawthorns the sawfly miner has a wider range of distribution. It is reported about Boston, Mass., and is common in the vicinity of New York City, Rochester, Ithaca, Geneva, and Skaneateles, all of which are located in the State of New York.

Amongst the natural enemies of *Profenusa* the most common is *Chogramma minutum*, an egg parasite, which destroys about 50 per cent of the sawfly leaf miner's eggs. Besides the foregoing parasite there has been reared an ichneumon which proved to be a new species and was listed by Rohwer as *Pezomorus tenthredinarum*.

The following methods of control are advised:

- 1) Picking and burning the affected leaves;
- 2) Fumigation with hydrocyanic-acid gas;
- 3) Ploughing and cultivating the ground so as to break up the cocoons of hibernating larvae.
- 4) Destruction of uncultivated host plants, especially the hawthorn of the *C. crus-galli* group.
- 5) Spraying of hawthorns with a solution of nicotine and soap.

670 - **Hazel Woods in the Province of Messina Invaded by Caterpillars.** (S. Patti, *Ann. R. Stazione Sperimentale di Agricoltura e Foresticoltura, Adriale*, 1915, pp. 1-18, Adriale, 1915.)

In the spring of 1915 various communes of the provinces of Palermo, Catania and Messina, especially the latter, suffered from an extraordinary invasion by the larvae of an unidentified Lepidopter, commonly called «campa del nocciuolo».

In the commune of S. Pietro Patti, one of the places that suffered most, these insects have been known to appear at intervals for the past century. They remain for a few years and then disappear. The fact that, in 1915, the hazel woods were subjected to a particularly severe attack may be due to the excessively damp and warm spring weather.

As soon as the hazel trees begin to bud they are attacked by the young caterpillars which devour all the young leaves. This occurs in S. Pietro about the end of April in other places the date may vary according to the geographical position. When the caterpillars on a tree become numerous that the foliage is insufficient to feed them, they proceed to devour the more tender branchlets and also the young fruit, thus completely destroying the crop. The young branches then wither up, and though the tree may regain a certain vigour it will only give a poor crop in the following year. Were these attacks to be repeated for several years the

infection, the woods would undoubtedly be ruined, in fact in some cases this has already happened.

As regards control the following facts are known:

The increased number of attacks is strictly due to the increased area covered by the woods.

These pests can no longer be disregarded as unimportant as besides causing the loss of the present year's crop, they will probably mean the loss of those of subsequent years also.

The only effective remedy is arsenate of lead (1 %) applied with necessary precautions. This method, however, being rather costly will be best to reserve it for extreme cases.

The best method of permanent control would be to convert the wild woods into cultivated plantations; hoeing and working of the soil is especially unfavourable to the hibernation of many species of insects.

The necessary increase of cost will be amply compensated by the increment both in quantity and quality of the produce.

The Citricola Scale (*Coccus citricola*) in California. QUAYLE J. in *Collection of California Agricultural Experiment Station, Bulletin No. 188*, pp. 309-312, Pls. 1-7 University of California Press, Berkeley, 1913.

The citricola scale (*Coccus citricola* Campbell) is one of the most injurious pests on citrus trees in California. It has been commonly known as the "leucanth scale" and has also been called the "False soft brown scale." The writer has, however, thought it best to call it the "citricola scale" as its first specific name. This scale seriously impairs the vigour of the tree and consequently greatly reduces the fruit production. It has in some cases reduced the crop some 50 to 75 per cent. and more.

The citricola is now widely distributed in California and this would tend to indicate that its occurrence dates considerably further back than first recorded appearance. It was first found in the vicinity of Claremont in 1899 and at about the same time near Riverside and in certain towns of San Bernardino County. It has been known in the citrus section of Tulare County for the past three or four years, although its occurrence in great numbers dates back but a year or two.

In the countries south of the Tehachapi the citricola scale is found in Los Angeles, Orange, Riverside, and San Bernardino. In San Bernardino city infestations occur at Colton, Redlands, Highlands, Rialto, Biltwanda, Pomona, Upland, and Ontario. In Riverside County the infested areas are in the vicinity of the city of Riverside and at Highgrove. In Los Angeles County they are at Claremont, Pomona, San Dimas, and Glendora. In San Bernardino County one infestation is found near Fullerton.

In the counties north of the Tehachapi the most general infestation is in Tulare County. The heaviest infestations occur around Porter, Worth, Globe, Success, Lindsay Exeter and Oroshi. In Fresno County the citricola scale occurs in the citrus districts of Mt. Campbell and near Sacto. In Sacramento County it occurs in the Fair Oaks and Orangevale districts, and in Placer County at Rocklin. In Yuba and Sutter countries has been reported from citrus trees growing in the cities of Marysville

and Yuba City. In Contra Costa County on one tree in Martinez, Contra Costa County on one tree near Bakersfield, but in these two last cases no treatment was given and the scale has not as yet reappeared.

The citricola scale, which is primarily a pest of citrus trees in California has been found on a few other plants, but in all cases these plants are growing in the vicinity of infested citrus trees. These include grape, pomegranate, elm and walnut.

The young appear about the last week in April and continue to appear until August. During the summer, autumn and winter the scales are found most exclusively on the leaves and grow very slowly. By November there is an appreciable change in size and colour. At this time also migration to the twigs begins. This migration from leaf to twigs continues through the winter but the great majority migrate in March and April. The scales remain more or less dormant until the warm weather when they grow very rapidly and produce eggs before May. The complete development of citricola requires approximately 100 days.

The most satisfactory treatment for the control of the citricola is fumigation with hydrocyanic acid gas between July 15 and September. Fumigation results are less certain later in the year. Where fumigation is not feasible, spraying with kerosene and kerosene emulsion should be adopted.

Among the natural enemies of citricola the following may be mentioned: *Coccophagus flavoscutellum*, *C. lunulatus*, *C. lecanii*, *Aphidius* and *Chilocorus hylarinus*. It is probable that some of the species of *Chilocorus* also feed on the citricola scale.

1918 - ***Brassolis sophorae*, a Butterfly Injurious to Coconut Palms in British Guiana.** - CHAPMAN, L. D. JR. in *Bulletin of Entomology and Research*, Vol. 7, 1918, pp. 273-278, Fig. 1-14. VIII-X, London, 1918.

During 1914 the coconut palms in the city of Georgetown had been rather severely attacked by the larvae of the Coconut Butterfly, *Brassolis sophorae* L.

The first appearance of *Brassolis sophorae* as a pest dates back 100 years. SCHOMBERG in his "Fauna und Flora von British Guiana" records it as being found on the coast-lands but gives no food plant. In 1905 it has been reported from Plantation Grove near Clonbrook, where the areas of coconuts were considerably damaged. In 1909 it again occurred in the Mahaicony district. Between 1909 and the present attack of *Brassolis* was of little importance and it would thus appear that it only occurs in such numbers as to cause considerable damage at intervals of about 5 years.

The attacks of this pest are not confined to the coconut palm, the common Cabbage Palm (*Orcadoxa oleracea*) is also attacked.

Little is known of the distribution of the coconut butterfly in British Guiana. It has been reported from Plantation Grove near Clonbrook in the Mahaicony district, and Georgetown in the county of Demerara and from Underneering, on the Essequibo Coast.

Outside of the Colony, *Brassolis* was recorded from Dutch Guiana

afterian, as early as 1795, and while she gives *Millera moniliformis* as the pest of the plant, adds that later she found a very large number on a high tree.

Guérin mentions it in his Catalogue of *Ichthyotera Rios Insecta* of Trinidad and gives the range as Guiana to South Brazil. The caterpillars eat the green part of the leaves, leaving only the central midrib and the lateral veins. They pass in this manner from leaf to leaf until the entire tree becomes denuded. The attack may be so severe that the tree perishes.

Fortunately this pest has many natural enemies. Many birds, particularly the common Kiskadee (*Prionoxystus salicinator*), feed on the adult caterpillars. Both the eggs and pupae are parasitised. Two species of parasites were also reared and are at present being determined. Recently the well known parasite *Chalcis areolaris* F. has been obtained from the pupae of this insect.

The habit of the larvae of living in "nests" during the daytime offers a means of controlling this pest. The nests can be easily seen from the ground, and by cutting down the branches bearing them large numbers of the insects can be killed.

Mites Injurious to Various Wild and Cultivated Plants in Sweden.—TOSCANONI, *Les Insectes et les Maladies des Arbres et des Arbustes en Suède* (Stockholm, 1904), pp. 120-121, 122, 123, 124, 125, 126, 127, 128, 129, 130, 131, 132, 133, 134, 135, 136, 137, 138, 139, 140, 141, 142, 143, 144, 145, 146, 147, 148, 149, 150, 151, 152, 153, 154, 155, 156, 157, 158, 159, 160, 161, 162, 163, 164, 165, 166, 167, 168, 169, 170, 171, 172, 173, 174, 175, 176, 177, 178, 179, 180, 181, 182, 183, 184, 185, 186, 187, 188, 189, 190, 191, 192, 193, 194, 195, 196, 197, 198, 199, 200, 201, 202, 203, 204, 205, 206, 207, 208, 209, 210, 211, 212, 213, 214, 215, 216, 217, 218, 219, 220, 221, 222, 223, 224, 225, 226, 227, 228, 229, 230, 231, 232, 233, 234, 235, 236, 237, 238, 239, 240, 241, 242, 243, 244, 245, 246, 247, 248, 249, 250, 251, 252, 253, 254, 255, 256, 257, 258, 259, 260, 261, 262, 263, 264, 265, 266, 267, 268, 269, 270, 271, 272, 273, 274, 275, 276, 277, 278, 279, 280, 281, 282, 283, 284, 285, 286, 287, 288, 289, 290, 291, 292, 293, 294, 295, 296, 297, 298, 299, 300, 301, 302, 303, 304, 305, 306, 307, 308, 309, 310, 311, 312, 313, 314, 315, 316, 317, 318, 319, 320, 321, 322, 323, 324, 325, 326, 327, 328, 329, 330, 331, 332, 333, 334, 335, 336, 337, 338, 339, 340, 341, 342, 343, 344, 345, 346, 347, 348, 349, 350, 351, 352, 353, 354, 355, 356, 357, 358, 359, 360, 361, 362, 363, 364, 365, 366, 367, 368, 369, 370, 371, 372, 373, 374, 375, 376, 377, 378, 379, 380, 381, 382, 383, 384, 385, 386, 387, 388, 389, 390, 391, 392, 393, 394, 395, 396, 397, 398, 399, 400, 401, 402, 403, 404, 405, 406, 407, 408, 409, 410, 411, 412, 413, 414, 415, 416, 417, 418, 419, 420, 421, 422, 423, 424, 425, 426, 427, 428, 429, 430, 431, 432, 433, 434, 435, 436, 437, 438, 439, 440, 441, 442, 443, 444, 445, 446, 447, 448, 449, 450, 451, 452, 453, 454, 455, 456, 457, 458, 459, 460, 461, 462, 463, 464, 465, 466, 467, 468, 469, 470, 471, 472, 473, 474, 475, 476, 477, 478, 479, 480, 481, 482, 483, 484, 485, 486, 487, 488, 489, 490, 491, 492, 493, 494, 495, 496, 497, 498, 499, 500, 501, 502, 503, 504, 505, 506, 507, 508, 509, 510, 511, 512, 513, 514, 515, 516, 517, 518, 519, 520, 521, 522, 523, 524, 525, 526, 527, 528, 529, 530, 531, 532, 533, 534, 535, 536, 537, 538, 539, 540, 541, 542, 543, 544, 545, 546, 547, 548, 549, 550, 551, 552, 553, 554, 555, 556, 557, 558, 559, 560, 561, 562, 563, 564, 565, 566, 567, 568, 569, 570, 571, 572, 573, 574, 575, 576, 577, 578, 579, 580, 581, 582, 583, 584, 585, 586, 587, 588, 589, 590, 591, 592, 593, 594, 595, 596, 597, 598, 599, 600, 601, 602, 603, 604, 605, 606, 607, 608, 609, 610, 611, 612, 613, 614, 615, 616, 617, 618, 619, 620, 621, 622, 623, 624, 625, 626, 627, 628, 629, 630, 631, 632, 633, 634, 635, 636, 637, 638, 639, 640, 641, 642, 643, 644, 645, 646, 647, 648, 649, 650, 651, 652, 653, 654, 655, 656, 657, 658, 659, 660, 661, 662, 663, 664, 665, 666, 667, 668, 669, 670, 671, 672, 673, 674, 675, 676, 677, 678, 679, 680, 681, 682, 683, 684, 685, 686, 687, 688, 689, 690, 691, 692, 693, 694, 695, 696, 697, 698, 699, 700, 701, 702, 703, 704, 705, 706, 707, 708, 709, 710, 711, 712, 713, 714, 715, 716, 717, 718, 719, 720, 721, 722, 723, 724, 725, 726, 727, 728, 729, 730, 731, 732, 733, 734, 735, 736, 737, 738, 739, 740, 741, 742, 743, 744, 745, 746, 747, 748, 749, 750, 751, 752, 753, 754, 755, 756, 757, 758, 759, 760, 761, 762, 763, 764, 765, 766, 767, 768, 769, 770, 771, 772, 773, 774, 775, 776, 777, 778, 779, 780, 781, 782, 783, 784, 785, 786, 787, 788, 789, 790, 791, 792, 793, 794, 795, 796, 797, 798, 799, 800, 801, 802, 803, 804, 805, 806, 807, 808, 809, 810, 811, 812, 813, 814, 815, 816, 817, 818, 819, 820, 821, 822, 823, 824, 825, 826, 827, 828, 829, 830, 831, 832, 833, 834, 835, 836, 837, 838, 839, 840, 841, 842, 843, 844, 845, 846, 847, 848, 849, 850, 851, 852, 853, 854, 855, 856, 857, 858, 859, 860, 861, 862, 863, 864, 865, 866, 867, 868, 869, 870, 871, 872, 873, 874, 875, 876, 877, 878, 879, 880, 881, 882, 883, 884, 885, 886, 887, 888, 889, 890, 891, 892, 893, 894, 895, 896, 897, 898, 899, 900, 901, 902, 903, 904, 905, 906, 907, 908, 909, 910, 911, 912, 913, 914, 915, 916, 917, 918, 919, 920, 921, 922, 923, 924, 925, 926, 927, 928, 929, 930, 931, 932, 933, 934, 935, 936, 937, 938, 939, 940, 941, 942, 943, 944, 945, 946, 947, 948, 949, 950, 951, 952, 953, 954, 955, 956, 957, 958, 959, 960, 961, 962, 963, 964, 965, 966, 967, 968, 969, 970, 971, 972, 973, 974, 975, 976, 977, 978, 979, 980, 981, 982, 983, 984, 985, 986, 987, 988, 989, 990, 991, 992, 993, 994, 995, 996, 997, 998, 999, 1000.

A description of various species of the genera *Tetranychus*, *Paratetranychus*, and *Tetranychus* which in Sweden damage the following plants: melon, bean, corn, vine, peach, palm and other hot house and glass garden varieties, apple, plum, lime, elm and poplar.

These mites fix their sharp pointed sucking organs into the leaf tissue and with the cell contents red-colored patches appear on the margins of the leaves which spread and mingle until the leaf withers up and dies.

The genus *Tetranychus* is found almost exclusively in the southern part. North of Upsala (60° lat. N.) it has been reported only three times, at Kopparberg once and at Hämesand twice.

Tetranychus pilosus Can. et Fars. ("Fruchtträdskvalstret").

Winter eggs of this species which are red in colour and spheroidal, sometimes cluster on the apple branches in such numbers as to give the branches themselves a red colour. The eggs hatch early in May and by the summer four generations mature in succession. Warm weather is most favourable to their development. The plants attacked are: plum, wild plum, and possibly also pear.

It has been reported at Lundeberg (district of Örebro), Alnarp, (S.), Vinslöy (Krist. L.) Hämesand (Västerg. L.), Järlåsa (district of Krist. L.), Hellsby Bruun (district of Söderm.) etc.

Tetranychus unguis Jac. ("Barrträdskvalstret"). This species has been seen in Sweden on: *Picea excelsa*, *P. alba*, *P. sitchensis*, and *P. mariana*, and on the larch. Winter eggs are laid and in the warm season the generations mature.

Tetranychus rubi n. sp. has been found only on *Rubus Idacus*.

Tetranychus althacee v. Hanst ("Växthusspinnkvalstret"). — This is the most widely spread and most injurious species; from early in May, through June, July and August it causes serious damages to cucumbers, melons, beans, garden plants and kitchen-garden produce; it is liable to attack also peach, palm and vine. In Germany this mite was observed on *Althaea rosea*, *Lycium barbarum*, *Phaseolus multiflorus*, *Bryonia cretica*, *Humulus Lupulus*.

According to reports from various places: Stenby (Stockholm), Lottenland (Malmöhus), Lenköping (Östergötl.), Geräsen (Örebro), and Tkerö (Stockholm), the development of the mites is the more rapid, the damage more serious and extensive, the hotter and drier the weather. *Tetranychus telarius* L. ("Vannliga Spinnkvalstret"). — Attacks lime, *Prunus Padus*, elm, maple and poplar. In Sweden it has been observed at Åkersta, Kristinehamn, Vadsbro, (Söderm.), etc.

It has been also found in North America, widely distributed from Ontario to Texas, and from British Columbia to California, in Southern the Hawaii Islands, and in Australia. With regard to means of control, knowledge of the animals natural enemies is too limited to be counted on; only one larva of *Coniopteryx* having been thus identified. The writer made various experiments with fungicides with the following results:

1) Comparative trials with applications of carbon bisulphide, quassia and nicotine; the following table is for cucumbers:

	Number of mites		
	alive per plant	dead	per leaf destroyed
Plants not treated	552	—	18.4
With carbon bisulphide	31	366	1.0
" quassia	78	—	2.6
" nicotine	86	—	2.8

The above table shows that the number of mites per leaf which on untreated plants average 18.4, decreases in those treated with carbon bisulphide to 1.0; with quassia, to 2.6; with nicotine, to 2.8.

2) Hot-house experiments against *T. althacee* made with 125 gms. of carbon bisulphide in 5 litres of water mixed with gelatine and 200 gms. of quassia and nicotine. The plants used for test purposes were cucumbers; the results surpassed every expectation, all the mites and their eggs being killed.

380 — Insects Injurious to Pine and Fir Trees in Sweden. — TRAGÅRD IVAR, in *Skogsskadeorsaken*, *Forstmannens Tidskrift*, Year XIII, Part 11, pp. 813-874, Figs. 1-49. Stockholm, 1901.

A list of microlepidoptera injurious to pine and fir trees in Sweden. *Pandemis ribeana* Hb., common in the central and southern portions of Sweden as far as Uppland. The larvae of this lepidopter are polyphagous and attack *Crataegus*, *Rosa*, *Prunus*, *Pyrus*, *Quercus*, *Rhamnus*, *Fragaria*, *Sorbus*, *Acer*, *Tilia*, *Betula*, *Ribes*, *Berberis*, and *Gaultheria*. The author has also noticed them in great numbers on the young pine trees of the Pin-

region near Stockholm, of which they devour the leaves and the cork of the young shoots.

Adria schützella Fuchs, injurious to pines; is similarly distributed in the south.

Epilobitha (Epiblema) tedella El. ("Granbarrvecklaren") causes damage of little importance to the leaves only.

Epilobitha (Epinotia) manana Tr. ("Dvärgbarrvecklaren"), has been mentioned for the first time as injurious at Fröstviken and Kvesjön, Norway, where numerous pines in those places were partly despoiled of their foliage but the young yearling shoots continued their normal development.

Ephestia illuminatella Zell. ("Granknoppsmalen"), attacks the growing tips and young leaf buds of pine trees and after destroying these, penetrates into the branches, burrowing galleries in the region of the bast, thus causing various growth anomalies. It has been reported, up to now, from the province of Stockholm, in the northern parts of Jämtland and in the Ålmar islands.

Phaenicia piceamp L. ("Tallvecklaren"), the larvae of which attack the needles of fir trees, and conceal themselves, in order to hibernate, in tufts of four leaves which they cause to stick together, forming a sort of web.

Chorisia resinella L. ("Hartsgallvecklaren"), the larvae of which destroy chiefly the cortex of the young shoots but also attack the leaves nibbling away at their bases.

Herzingia dodecella L. ("Tallskottmalen"), during the first stage the larvae remain on the fir leaves; later they destroy the buds causing very serious damage; they have been found at Skane, Småland and Gotthard.

Choristis gysselinella Dup. ("Större Tallbarrmalen"), is harmful to the needles of firs.

Proctodestis farinatella Zell. also attacks the leaves of firs.

Oncerosoma piniaricella Zell. ("Grua Tallbarrmalen") attacks and gnaws the leaves; is frequently found in Skane, Småland, Gotthard, and Uppsala; the writer has also found it at Rammarö near Sandhamn, Nyås and Sköglög. In all these places the damages caused are very serious, and would be still more so were not the spread of *Oncerosoma* actively controlled by its natural foe, *Agonaspis fuscicornis* Dalm.

2. **Insects Injurious to Timber in Sweden.** — KEMNER, N. A. in *Motdelande N. 108* of *Centralanstalten för Jordbruksområdel, Entomologiska Arbeten* (n. N. 10), pp. 1-11, 1-13, 1-33, Stockholm, 1915.

The insects that are specially injurious to timber in Sweden belong to the family of Anobiidae ("Trägnagarna").

Anobium striatum Oliv. (*An. domesticum* Geoffr., *An. pertinax* Fabr., *Stemmiga trägnagaren*) attacks *Abies* sp., *Betulinae*, *Fagus sylvatica* attacks often oaks and ash.

This insect is common in the southern and central districts of Sweden, but has recently been reported also from places situated beyond what was formerly believed to be the northern limit of its distribution.

An. pertinax L. (*An. striatum* Fabr., "Envisa trägnagaren") is found

in the southern and central regions; it has also been reported by L. G. Like the preceding species it attacks *Abies* and some Amentaceae, but, however, but slight damage.

Xyletinum rubicollum D. G. (*X. tessellatum* F., *X. phagae* L., "Skäckiga trägnagaren") attacks preferably oak trees but is also found on beech and on *Pinus silvestris* and *Tuscus baccata*.

Ernobius mollis L. ("Mörka trägnagaren") is distributed all over Sweden. It burrows galleries between the bark and the wood, and the former is very thin, may even penetrate to a depth of some centim. into the wood.

Ptilinus fectinicornis L. ("Kambormade trägnagaren") is found all over Sweden where it damages not only standing trees but also wood. It attacks oak, beech, alders, maple, walnut, willow and other kinds of trees.

Amongst the chief natural enemies of *Anobiidae* are: *Ophion* L., Sturm., *O. mollis* L., *Corycaeus ceruleus* D. G. and *Tillus elongatus* L., special enemy of *Pt. fectinicornis*, which kill the perfect insects. There are also some Hymenoptera the larvae of which are parasitic on the eggs of *Anobiidae*: *Homites completus*, *Lissonota arvicola*, *Polysphincta* L., *P. sora* for *Pt. fectinicornis*, and *Thecolax formiciformis*, *Hemiteles* L., *Pimpla flavipes*, *Brachon spathuliformis*, *Spathius clavicornis*, *S. cellaris* and *Typhaeus tuscipes* for *An. striatum*.

As means of control for these insects the following may be suggested: 1) In the case of furniture or similar articles, fumigation with bisulphide may be effective; linseed oil should be applied after the articles are polished. Good results may also be obtained by the action of turpentine and petroleum.

2) For wooden partitions and floors, petroleum mixed with water.

3) For wood stores, carbolineum is advisable.

4) These precautions should be taken more especially in April-June, at the time when these insects are swarming.

